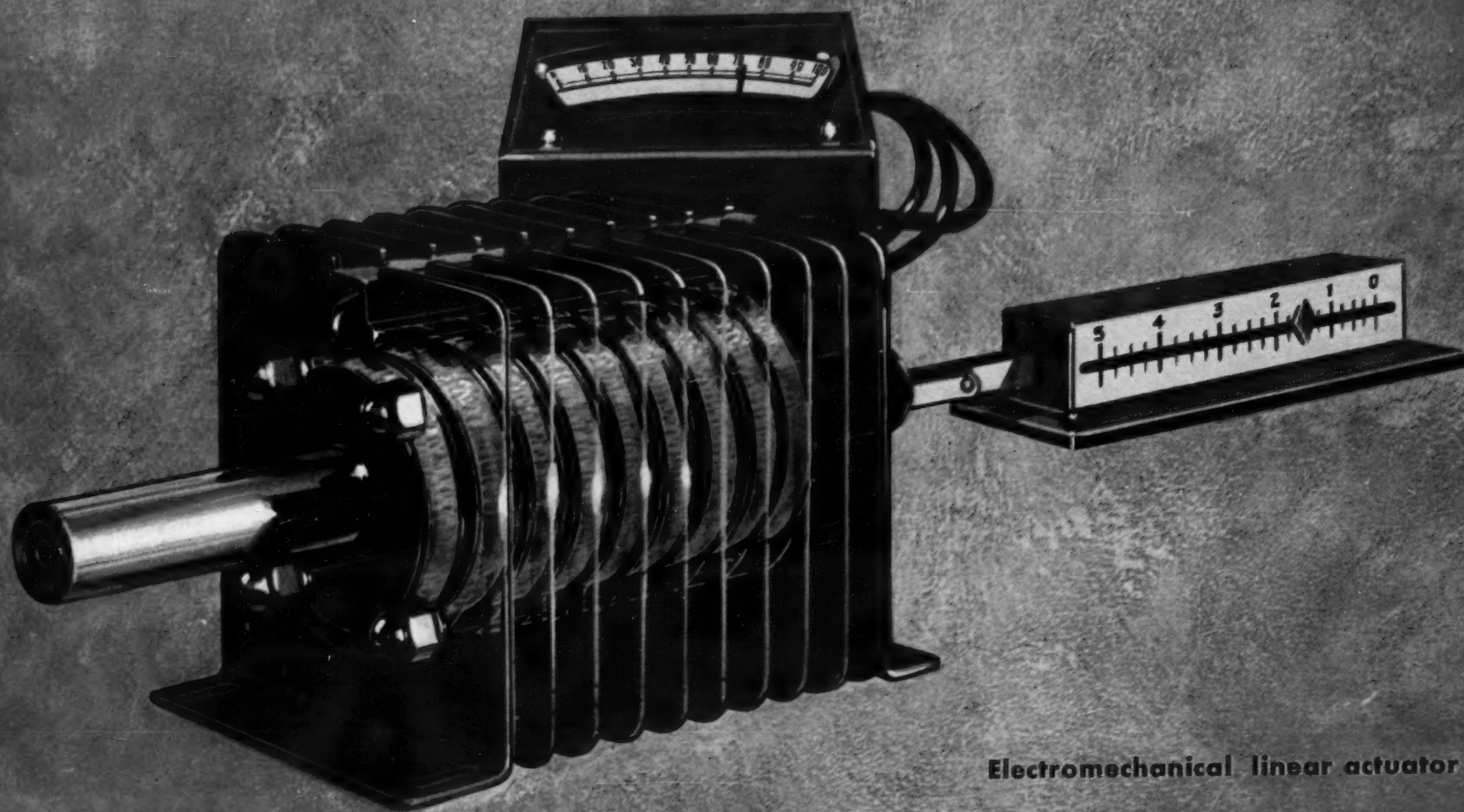


# Design News



**Electromechanical linear actuator**

**DESIGN SHOW, MAY 22 THROUGH MAY 25**

**A CAHNERS PUBLICATION**

**MAY 8, 1961**

# ANNOUNCEMENT

## CONCERNING

### SHALLOW & DEEP ROLLING

# DIAPHRAGMS

**NBP** May 8, 1961  
Vol. 16 No. 10 **EPA**  
Worldwide Coverage of Technical

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Published bi-weekly by Rogers Publishing Co., Inc., a Subsidiary of Cahners Publishing Company, Inc. Editorial, Advertising and Subscription Offices: 3375 S. Bannock, Englewood, Colo. Telephone: SUNset 9-0571.

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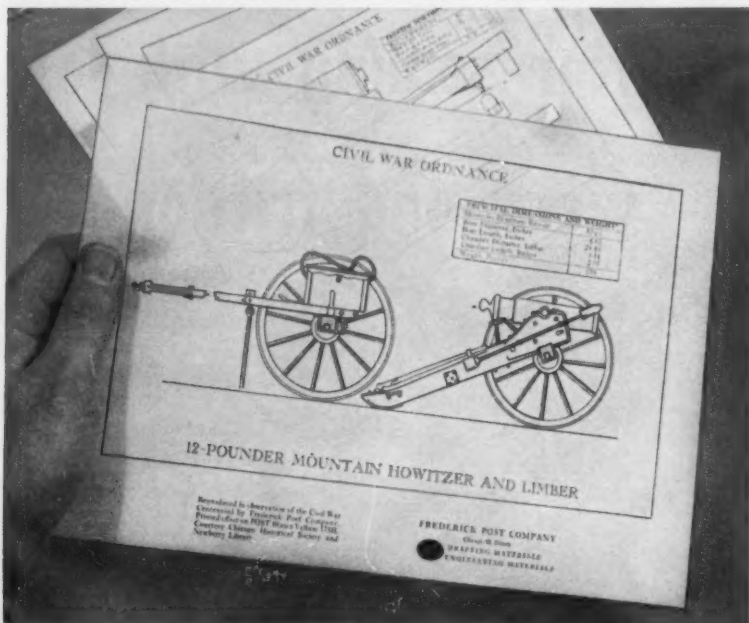


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## SOUNDING BOARD

FOR OUR READERS



### Spare Parts, Reliability—or Low Bid

Referring to the statements of Dan Foley . . . in the April 10 issue of DESIGN NEWS ("Sounding Board"), I want to object firmly.

He makes absolutely unwarranted and malicious statements on the incompetence and dishonesty of the majority of Civil Service employees of the U. S. Government.

Time and again it has been stated rightfully that these employees displayed profound knowledge, experience and outstanding loyalty in job performance.

For the vicious slander against the U. S. Government Civil Service employees by Mr. Foley and the oversight by the Editor of DESIGN NEWS for publishing those statements an unequivocal apology is due.

CHARLES A. SUEL, Mech. Engr.  
Picatinny Arsenal  
Machine & Tool Des. Br.

• Both Mr. Suel and Mr. Foley are entitled to their opinions.

### A Place to Stand

Congratulations on your excellent editorial, "A Place to Stand", which appeared in the Feb. 13, 1961, issue of DESIGN NEWS.

You have focused attention on a problem of considerably greater magnitude, I believe, than many are aware of or will admit. A serious result of this is that it must certainly be a contributing factor to the difficulties many organizations are confronted with today. . . .

GLEN C. HARTIG  
Evansville, Ind.

Your editorial, "A Place To Stand", in the Feb. 13 issue of DESIGN NEWS reveals the same fuzzy thinking about the engineering profession you indulged in when you discussed "Dead End Engineers" last November. Mr. Hull's comments obviously have not taken effect. Stand by for another attack.

You equate the man with "applied knowledge of mechanics" with "the graduate engineer whose knowledge is acquired largely through the college textbook". On the contrary, a licensed professional engineer must have practical experience. . . .

You say the technician is qualified to advance to a professional title "after years of specialization on the job." This is precisely why the technician is not an engineer. . . .

In addition, you confuse the "know-how" needed for management with the "know-how"

needed to be an engineer. Perhaps your hypothetical technician deserves more recognition than he is getting; perhaps he deserves promotion to management up to and including "Chairman of the Board". This I will not argue and cannot say, but I will say he is not by virtue of "applied knowledge of mechanics" or "years of specialization" an engineer and certainly not a Professional Engineer as established by law.

EDWARD J. KALISKI, P. E.  
Wilmington, Del.

• No comparison was made with registered professional engineers. P.R.T.

### 'Dead-End' Engineers

H. B. Lyon in the "Sounding Board" column of DESIGN NEWS of Feb. 27 has defined correctly the purpose of lawyers and doctors, but has stumbled badly on defining that of engineers. Engineers are dedicated to the eradication of drudgery, which, as a high purpose, is at least on a par with that of lawyers and doctors—or higher, considering that doctors and lawyers could almost be eliminated by education.

RALPH PARDUCCI  
Design Engineer  
Pardycomp Instrument Co.

### Rubber Stamps

Your article in the March 13, 1961 issue of DESIGN NEWS concerning rubber stamps for mechanical drawings has been read with much interest.

Certainly the use of any short-cut methods is a much overlooked approach in many engineering departments. For a number of years we have abbreviated our drawings to the extent that they appear on face value as being very meager line drawings. However the gage of a good drawing is not determined by the amount of lines appearing thereon, but by the clarity, correctness and only enough information to make that drawing clear to the shop personnel.

Also, along these same lines we have for a number of years used the "Stanpat" method of applying notes, various assembly details and so forth to drawings.

We believe that articles such as yours should appear more frequently in the various journals.

J. R. CLABAUGH  
Chief Draftsman  
The C. S. Johnson Co.



## DESIGN VIEWS



### The Design Engineering Show

Trade shows have been on the American scene for quite some time. The woodcut above is an artist's view of the American Institute Show in New York which was held October 1859. There were machines of all descriptions at this show which represented in essence the beginning of the Industrial Revolution in America.

Since that date trade shows have been held in all major population centers. The difference is that they have become more specialized over the years.

A case in point is the Design Engineering Show and Conference which will be held in Cobo Hall in Detroit, May 22-25. This is the one show which is aimed directly at the design engineer. As such, it holds special interest for readers of DESIGN NEWS. Once again DESIGN NEWS will display some actual design ideas which have appeared in these pages during the past year. The DESIGN NEWS booth will be No. 756. The editors hope to see you there.

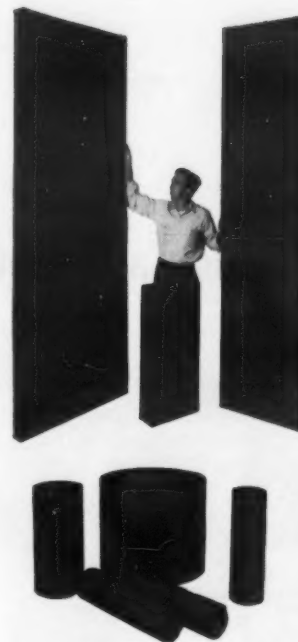
Since many readers will not be able to attend the show, we are making a special effort in this issue to preview some of the products that will be shown. The entire New Products section in this issue is devoted to products being shown at the Design Show. This is also true of our New Literature section. Our cover article will be displayed in actual hardware at our booth and you will be able to operate this unusual linear actuator. The clever design idea embodied in the article on page 122, using contoured stacks of "Mylar" to act as a three-dimensional cam, will also be displayed in our booth.

Along with the Design Engineering Show, there is a conference sponsored by the Machine Design Div. of ASME. Because the show will be in Detroit for the first time, the opening session will be devoted to design engineering in the automotive field. A list of the papers to be given during this conference is on page 149 of this issue.

More than 400 companies will participate in the Design Engineering Show which promises to be the largest held since the start of this stimulating event. I am personally looking forward to meeting a great many readers in Detroit.

*J. P. Dubois*

Executive Editor



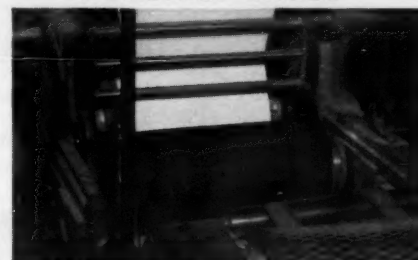
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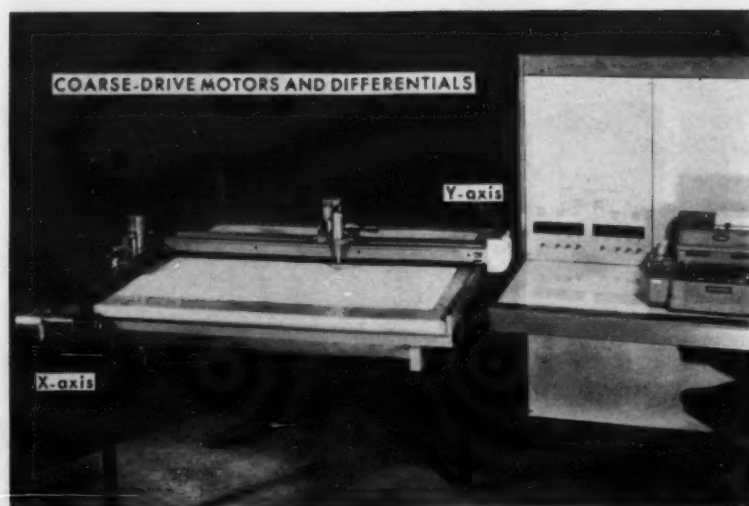
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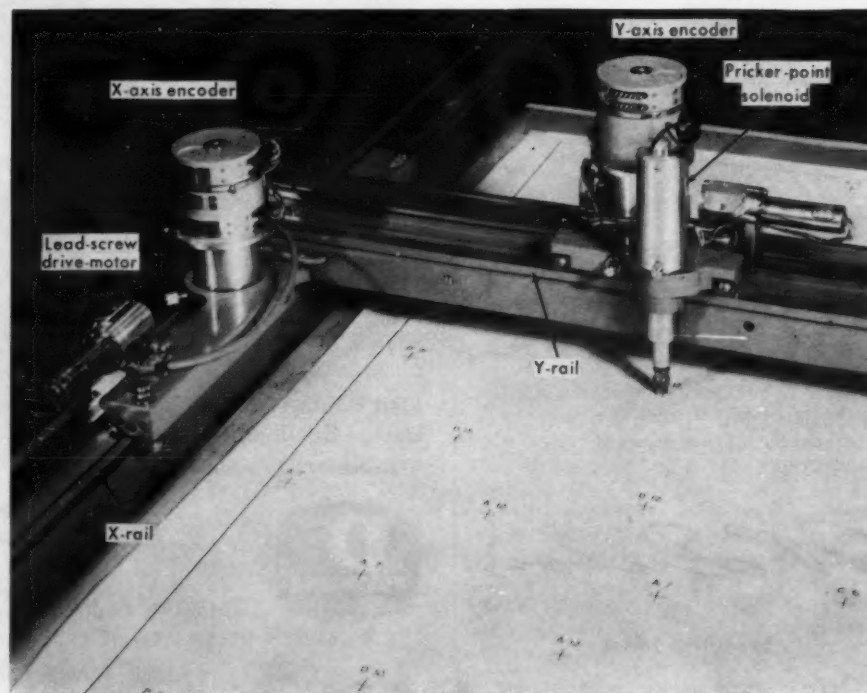
## Programmed Tape Plots Layout Points Automatically

E. J. Stefanides, Central States Editor



**COMPLETE SYSTEM** consists of electronic control console and plotting table. Layouts are usually made on dimensionally stable glass or aluminum to preserve 0.0015-inch accuracy. Feedback data is displayed continually in both modes of operation. Directly coupled feedback system always retains zero reference.

**CLOSE-UP OF AUTOMATED COORDINATOGRAPH** in use on actual layout to prepare tape for control of Wiedemann turret punch press. Numbered crosses indicate holes to be punched in production of steel or aluminum chassis. Cross hairs of pricker-point optical reticle are positioned over point to be read by manual switching. When in position, another switch is actuated, displaying and encoding on tape coordinates of unknown point. In reverse function plotting from pre-programmed tape, carriage (Y-axis rail) and pricker-point carrier are progressively driven into coincidence by decoded, three-speed steel-tape coarse drive and lead-screw fine drive. Carrier and carriage are ball-bearing mounted to eliminate lost motions.



PHILADELPHIA, PA. — Numerically controlled equipment for precision lofting and drafting has been developed by the Franklin Institute Laboratories in cooperation with the Aero Service Corp.

The device has two automatic capabilities. First, when used as a plotting device, it can plot tabulated points from data encoded on programmed tape. Second, it may be used to automatically read out coordinates of unknown points, encoding the data on tape for use as impact data for other digital equipment.

The equipment is designed around a coordinatograph, a precision, manually operated plotting table manufactured by Haag-Streit, Ltd., Switzerland. The electromechanical components for the drive

and feedback functions were designed so that they could be adapted to the manual device without impairing its original accuracy or requiring machining of any kind.

X- and Y-feedback components consist of highly resolved, five-place digital encoders. They are actuated by the same gear and rack arrangement which operated the vernier dials of the original, manual version. Digital data from the encoder are fed back to the comparison and readout circuit of the console by two 60-conductor, flat "Mylar" tapes.

The drive system is completely divorced from feedback components and also is adapted to replace existing mechanisms on the device. Coarse drive is provided by endless steel tapes which are driven by drive sheaves and which replace a steel tape-measuring system used to give rough position readings on the original device. Each of the drive sheaves is driven through a differential drive by two separate electric motors. The motors are driven in various combinations to give three coarse drives of 3, 0.3 and 0.03 ips.

Final positioning is accomplished by a separate fine drive consisting of electrical motor-driven, short lead screws which provide a 0.003-ips drive speed.

In operation, circuits of the electronic console compare the feedback position with the input data in sequentially shifting from coarse to fine drive as the values approach coincidence. When the two values reach coincidence, a solenoid-controlled pricker-point is actuated to mark the layout.

The electronic circuitry for the readout and comparison functions is contained in a separate console. It includes a "Flexo-writer" for programming input data directly from pricker-point feedback. Both versions of this device are marketed by the Aero Service Corp., Philadelphia, Pa.



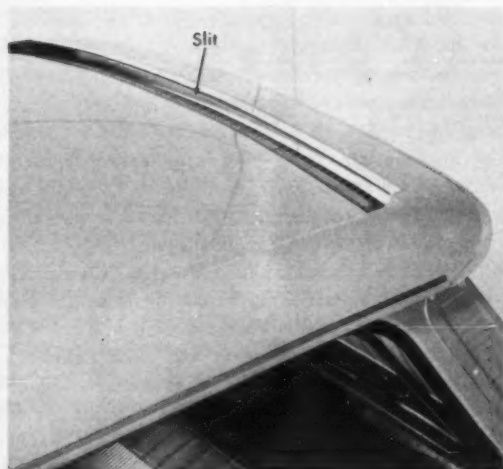
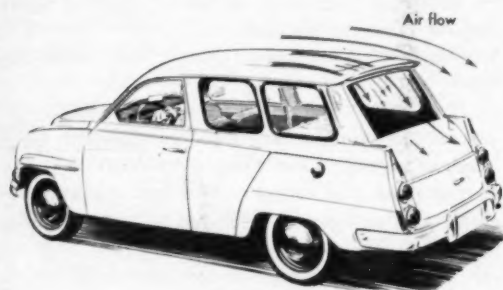
## Air Deflector Keeps Dust Off Station Wagon Rear Window

Volrath Holmboe, Correspondent in Sweden

TROLLHATTAN, SWEDEN—A slit in the overhang at the rear of the roof deflects air downward along the back window of the new SAAB 95 Station Wagon. The arrangement keeps dust and dirt off the rear window. During rain, clean water from the roof is washed through the slit and over the window. The slit is also claimed to have a favorable effect on aerodynamic drag of the vehicle.

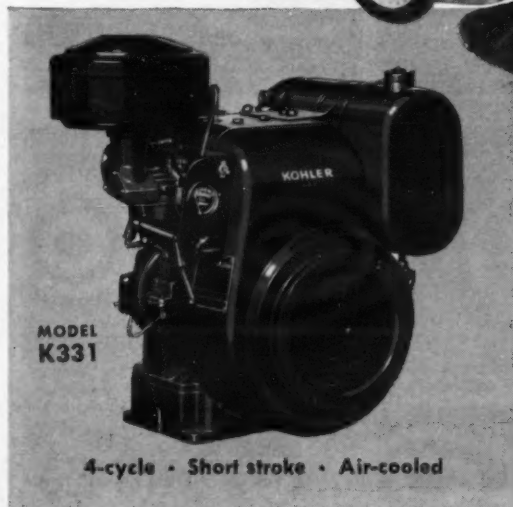
The rear seat in the car faces backward for better utilization of inside space. Entrance to the seat is through the back door, which opens upward and is hinged at the roof overhang.

Designed and manufactured by SAAB Aircraft Co., the vehicle has a seat capacity of seven. Engine power is 42 hp.



"The Roustabout", rugged, three-wheel truck-workhorse, powered by a K662 Kohler engine.

A model K91 Kohler engine powers the G. H. Tennant Co. Model 40 heavy duty sweeper for foundries, taconite plants—places with extreme dust conditions.



## KOHLER ENGINES

### Stamina that stands up ... and stands out

More and more Kohler engines are winning their place on new equipment by superior test performance . . . Long-term applications demonstrate their lasting reliability . . . Built-in stamina pays off in extra staying power and cost-saving efficiency.

Quality engineering proves its value in action . . . Hot spark insures fast, all-weather starting . . . Large bore and short stroke design cuts engine friction, increases power and prolongs life . . . Balanced crankshaft reduces vibration.

Kohler Co. has manufactured internal combustion engines since 1920 . . . Sales and service nation-wide.

See us in Sweet's Product Design Catalog

From 4 to 24 H. P. • Write for illustrated booklet

KOHLER Co. Established 1873 KOHLER, WIS.

## KOHLER OF KOHLER

ENAMELED IRON AND VITREOUS CHINA PLUMBING FIXTURES • ALL-BRASS FITTINGS • ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS

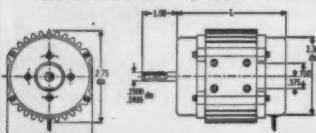
Circle 5 on Reader-Service Card for more information

# AC

Thousands of these precision motors from Air Marine have been used both by the military and industry. The "E Frame" shown below is offered in either induction or hysteresis synchronous versions.



"E FRAME" (Finned)  
3.68" Overall Length  
For Continuous Duty Application



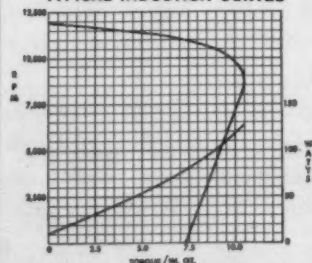
#### Induction

200 V., 3 phase 400 cycle  
1/10 H. P. at 10,500 RPM  
Torque, Starting 7.3" oz.  
Torque, Running 9.0" oz.  
Insulation to specs.

#### Hysteresis

115 V., 1 phase 400 cycle  
Sync. Speed 8000 RPM  
Starting Torque 3.0" oz.  
Pull-in Torque 2.6" oz.  
Pull-out Torque 2.7" oz.  
Locked Rotor Current .92 amps

#### TYPICAL INDUCTION CURVES



Air Marine offers a complete line of fractional AC motors, blowers and fans. Motors range in size from 1/1000 to 1/2 H. P. 400 cycle units are designed for airborne application. Specify your needs and let Air Marine deliver.



**air marine**  
motors, inc.

369 BAYVIEW AVENUE  
AMITYVILLE, L. I., N. Y.

2221 BARRY AVENUE  
LOS ANGELES, CALIFORNIA

## Top Two Together

### Complete Line Now Available

Air Marine Motors of Amityville, New York and Motordyne of Los Angeles, California have combined to offer industry an extensive line of both AC and DC motors in the fractional horsepower range. Motors from these companies have for years fulfilled the requirements of both industry and military. The wide variety of types offered makes this source invaluable to the design engineer. Comprehensive literature on units to fulfill specific needs is available from either the east or west coast facilities.

#### Quality is a Statistic

Motors from Air Marine and Motordyne have gained a reputation of reliability based on the quality of performance. Numerous units designed for the military have continually met rigid environmental requirements. Hundreds of pages of statistics are available to establish beyond any doubt the ability of these motors to meet all types of specifications.

#### Research and Development

Laboratories are maintained on both the east and west coasts, under the direction of highly competent engineers who continually probe for more advance techniques in the manufacturing of rotating components. The AC and DC motors of these corporations are continually being studied to increase their life and efficiency. These laboratories also study specific problems of customers relative to motor performance.

#### Engineering Consultation

The field engineers of Air Marine and Motordyne are trained to assist the customer in the selection and installation of motors. These engineers are often called upon by the customer to assist in specifying the right motor for a specific job. A call to either the east or west coast facility will alert these engineers to your specific problems.

#### Additional Lines from Air Marine and Motordyne

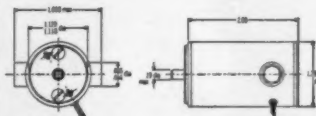
Now from these extensive facilities a complete line of blowers, fans, governors, breaks, gears, servo motors and thermal overload switches have become available. Complete information is available on request.

# DC

Another precision motor from Motordyne capable of meeting the most stringent specifications. Hundreds of planetary gear speed reducers are offered as well as brakes, governors, clutches and thermal overload switches.



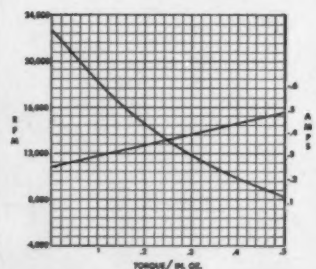
SERIES 1200, REVERSIBLE MOTOR



Power Supply 24-28 volts  
Line Current .5 Max. amps  
Speed 10000 RPM  
Output .004 H. P.

Continuous Duty .5" oz.  
Intermittent Duty 1.0" oz.

#### TYPICAL CURVE



If you face a DC motor application problem let a Motordyne field engineer assist in the solution. For prompt attention contact either the East or West Coast facilities.



2221 BARRY AVENUE  
LOS ANGELES, CALIFORNIA

369 BAYVIEW AVENUE  
AMITYVILLE, L. I., N. Y.

## SEEN AND HEARD

### SALESMAN . . . ENGINEER WITHOUT CONSCIENCE

Edward W. Schrader, Western Editor

A chance meeting in a San Francisco restaurant produced a new definition of a salesman.

Caught between flights, a stranger occupied the opposite chair at dinner. The usual conversation about "cabbages and kings" started.

The stranger, after imbibing his brand name martini, answered my question about his associations with, "I am an engineer."

Thus informed, we quickly passed over the usual conversation about the stockmarket and proceeded toward a more common ground of interest—engineering. This brought forth the statement, "Well, I am now in sales; I used to be in engineering. We are in the capital goods business. We catch them once and can't sell them anything more for 20 years."

The man in the \$150 suit went on to say, "So you're an engineer too?"

"Yes, and now an editor."

"So, then you have a conscience?"

"Yes, don't all engineers, as well as editors?"

"Sure, but you have to be in sales to make money," said the gourmet.

"But, I have a certain freedom, and I enjoy my work."

"That's well and good, but you will have to get rid of your conscience if you are going to be a success."

End of tale.

Moral: Don't pick up strangers in \$150 suits that order dry, dry beverages.

### DESIGN DISCIPLINE . . .

will be emphasized in the engineering education at the University of California, Los Angeles. Though we learned of this new approach in engineering education from a press release, it is worthy of special comment. L. M. K. Boelter, Dean of the College of Engineering, says, "All engineering students from freshmen to Ph.D. must learn to apply the fundamentals of their professions to engineering techniques of the present and future."

The release goes on to point out, "One of the most urgent needs is for senior professional staff members with considerable experience in the field of design. Design discipline has been called the crowning point of engineering education—the one which basically distinguishes the function of the engineer from that of the scientist."

As an engineer-editor, I find this approach to

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Circle 7 on Reader-Service Card





engineering education most heartening. Would that more universities devote time and effort to the special skills required of an engineer. Practical and useful design is based on the basic and fundamental principles of mathematics and the physical sciences.

In the past, only experience and maturity have welded together in a man's mind the ability to comprehend the fundamentals as related to ideas. An instructional staff of seasoned designers can make the engineering courses more useful to the students and speed their growth in the field of design.

#### CRACK DETECTORS . . .

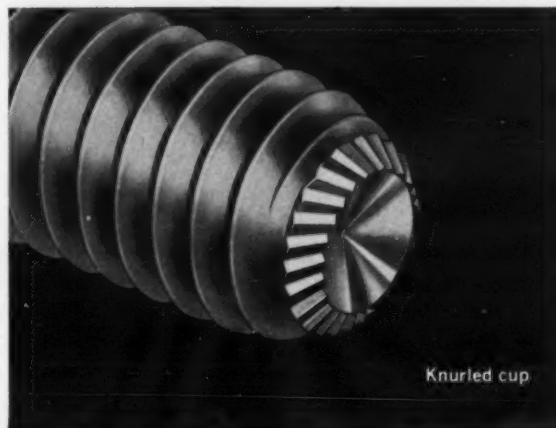
is a term no longer applicable to the Society of Nondestructive Testing. At a recent conference, the senior members concisely pointed out that they are concerned with the problems on exotic materials and in standardization.

The G.M.C. member explained that nondestructive testing fits into research and into standardization in the auto industry, that there is a need for international standards in the field. It is quite conceivable that engineers in England might be forced to work with American standards and vice versa. Therefore, it is necessary to arrive at standards on an international scale which will adequately predict the properties of materials by inspection.

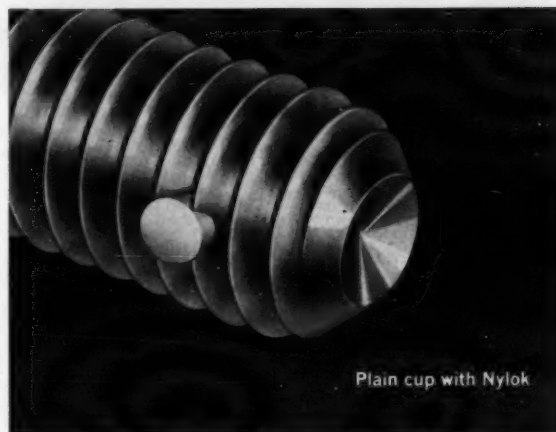
Nondestructive testing means different things in different types of industries. For example: at Union Carbide and Chemical, testing is in the roll of safety for examination of high-pressure vessels because of hazards; at Oak Ridge, nondestructive testing is in the area of metallurgical research and to advise on design plus inspection for both in-process and end products; at Aerojet General, it is in the field of quality control dealing through a reliability group.

Maj. Gen. Thomas P. Gerrity, in an address to ASM and SNT, disclosed that recent Titan I Missile difficulties stem from metallurgical failure of a hydraulic flow control valve. The particular castings were put through all the standard tests—periodic physical and chemical analysis, full functional tests and final visual inspection. He went on to say, "Yet we lack adequate means of nondestructive testing of the hardness and strength of each valve before it is installed in the weapon system. The failures, though not frequent, have been costly."

## Fine points in the art of selecting set screws . . . by UNBRAKO



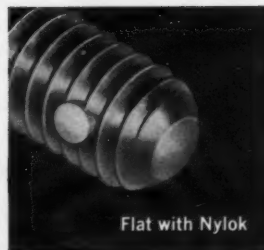
Knurled cup



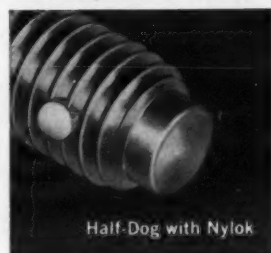
Plain cup with Nylok



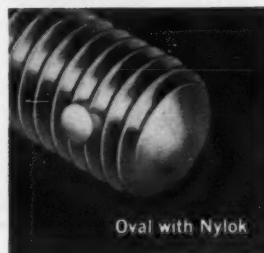
Cone with Nylok



Flat with Nylok



Half-Dog with Nylok



Oval with Nylok

When holding power is paramount in your designs, you turn to set screws. But two questions may arise: What brand? And what point? UNBRAKO offers satisfactory answers to both . . . in a complete range of set screws for every application.

**UNBRAKO with Knurled Cup Point.\*** Ideal where quick and permanent location of gears, collars and pulleys on shaft is called for, this set screw is at least *five times as vibration resistant* as its closest competitor.

**UNBRAKO with Plain Cup Point and Nylok.†** Also self-locking, this set screw—owing to the resilient nylon pellet—locks securely in place whether seated or not. Use it against shafts too hard for the knurled cup point to bite into or where fine adjustments must be held.

**UNBRAKO Cone, Half-Dog, Flat and Oval Points.** There are instances when neither the knurled cup nor the plain cup with Nylok will fulfill the requirements of your design. Then you will need one of the following point types:

- **Cone**—for permanent location of parts; as a pivot in machine design (when point has hardness of at least Rc 45); for making fine adjustments over a limited distance.
- **Half-Dog**—for permanent location of parts; in place of dowel pins; against hardened members or on hollow tubing when Nylok insert is also used.
- **Flat**—for frequent resetting of one machine part in relation to another; as an adjusting screw for fine linear adjustments; where wall is thin; on top of plugs made of soft material.
- **Oval**—for frequent adjustment without excessive deformation of part against which it bears. Also for seating against angular surface.

To build in a guarantee of locking, you will want to specify the Nylok feature for all set screws except those with the knurled cup point.

• • •

UNBRAKO socket set screws are available in sizes #0 through 1 in. in alloy and #0 through 1/2 in. in stainless steels. Ask your UNBRAKO distributor for more details. For booklet on UNBRAKO High Torque Set Screws write to Standard Pressed Steel Co., INDUSTRIAL FASTENER DIVISION, SPS, JENKINTOWN 6, PENNSYLVANIA.

\*Standard, at no extra cost

†T.M. Reg. U.S. Pat. Off., The Nylok Corporation

# SPS

where reliability replaces probability

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## Dieless Investment Castings for Prototype Testing

Investment Castings from Easily Fabricated Plastic Patterns Give Fast Answers to Design and Development Problems

E. J. Stefanides, Central States Editor

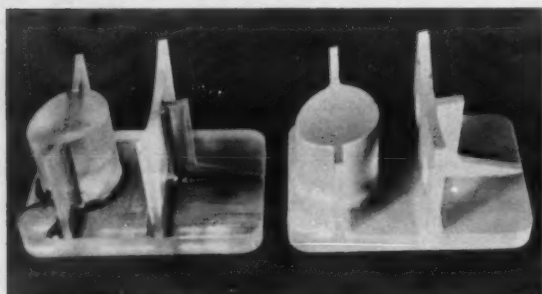
A new, universally available technique for the production of prototype investment castings has eliminated what was once a major drawback to employment of this precision-casting process. Investment castings for prototype testing are possible before the design is frozen and before the dies are bought. Castings are produced by means of expendable, easily fabricated polystyrene patterns that can be made without conventional pattern dies or tooling.

The technique was originated in the early development days of the X-1 hypersonic rocket plane to provide reliable cast parts for test in the shortest possible time. Since then it has been tested thoroughly in hundreds of custom applications.

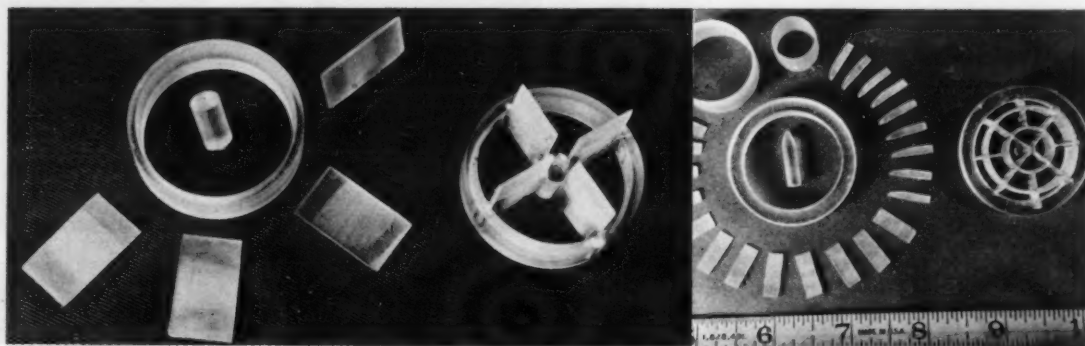
### Advantages of Cast Prototypes

First and foremost of the advantages resulting from use of the technique is the early coordination it develops between the customer and the foundry. This eliminates many of the unnecessary costs and problems which can be designed into castings long before the foundry is asked to quote prices and estimate delivery.

In many cases, casting designs submitted to the foundry are but drawings of machined or welded structures used in development work. When these designs are finalized and frozen before proven to be castable, it may require months or years to effect a castable redesign. Sometimes, particularly in the case of military subcontracting, the product becomes



ASSEMBLED POLYSTYRENE PATTERN used in preparing mold for 355 aluminum alloy prototype, investment casting.



COMPLEX PATTERNS are broken down into components. Components are machined from standard sheets, bars and tubes of polystyrene stock and assembled with plastic adhesives.

obsolete before redesign is permitted or even worse, its production never materializes beyond the initial test models.

Use of the prototype casting technique helps to locate and correct these design and production problems before the original design is frozen and while the product is still in the development stage.

### Research and Development Use

When used on a research and development basis, the technique provides a number of additional advantages.

The prototype of an investment-cast part undergoing development testing is an actual investment casting. Test results therefore can be correlated directly to the performance of a production part and the designer will have correct data on how the production parts can be expected to perform in service. If the test part is made by any other method, such as models hogged from bar stock or fabricated by weldment, then the performance of the production casting may or may not be the same as the part tested in development.

Since conventional pattern tooling is not required to obtain patterns for the cast prototypes, each of the polystyrene patterns assembled can be different. Thus, any number of different designs for the same part can be produced by means of the low-cost, easily

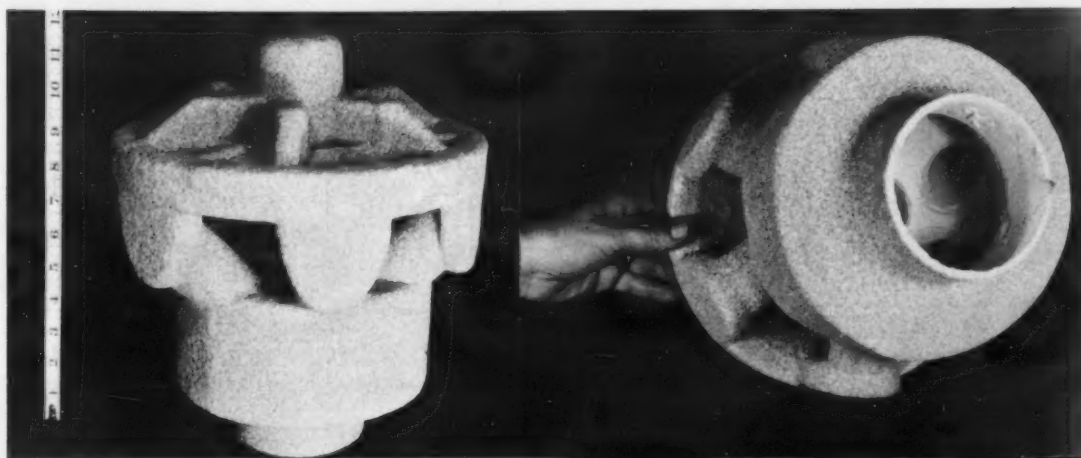
fabricated patterns. If desired, each design can be cast in different alloys.

Prototypes can be provided in three to five days after receipt of patterns. This can effect a considerable reduction in development lead time, and can be used to give fast answers to design, material and functional requirements.

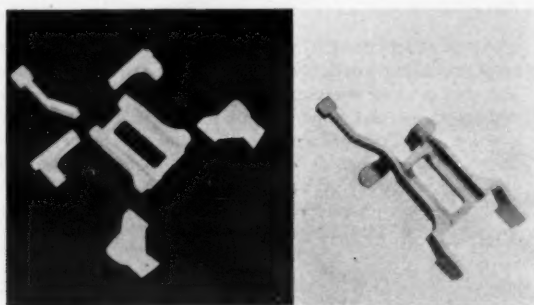
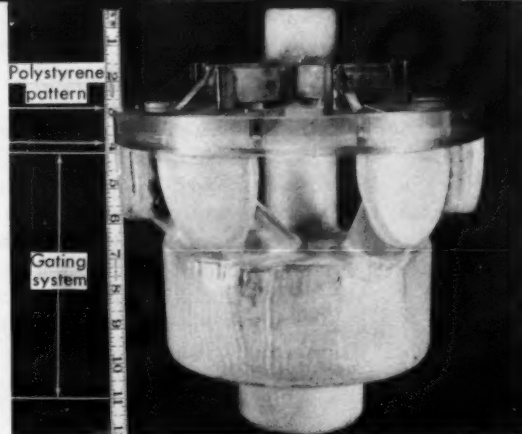


SIMPLE PATTERNS may be machined from single piece of polystyrene. Pattern is shown at lower left. Prototypes are cast in Stellite No. 12 alloy, an extremely difficult metal to machine. Part is now in production with design changes established from cast prototypes. Tube measures 0.183-inch ID by 0.500 inch long. Diameter of port holes in side of tube is 0.112 inch.



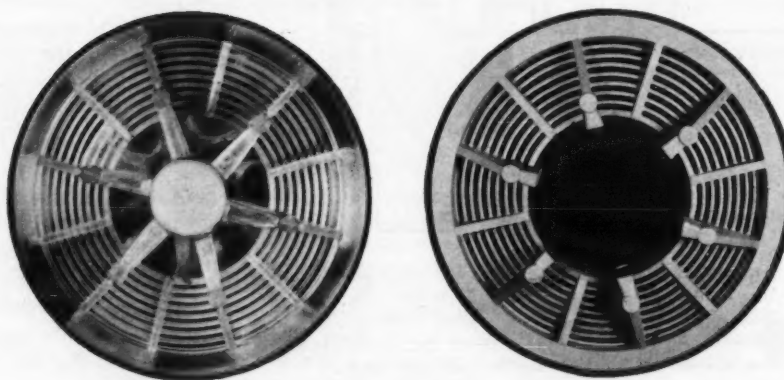


**CERAMIC SHELL MOLD** is made from pattern setup shown. Pattern setup calls for careful consideration and control. For optimum results, pattern must be positioned precisely and gated properly to achieve sound solidification of cast part. Shell is built up through series of laminations by consecutively dipping pattern in refractory slurry and "stuccoing" or coating with dry refractory materials. After shell has been formed and properly dried, setup is burned out in 1800F furnace. Shell is then fired at 2000F to develop ceramic properties. Casting is poured while mold is still hot after final firing.



**EASILY MACHINED PARTS** for complex pattern used to produce steel investment casting shown on right.

**INTRICATE PATTERN DETAILS** and their precise reproduction in prototype casting. Casting may be poured by gravity, centrifugal, pressure, suction or vacuum-casting techniques. Selection of pouring technique is dependent on numerous factors including the configuration of casting itself.



### Pattern and Prototype Production

Cast prototypes are produced in sizes and alloys compatible to the investment-casting process. Production of the patterns and prototype castings is a cooperative effort on the part of the designer and the foundry.

When the initial design has been completed, a print of the prototype drawing is sent to the foundry offering prototype service.

The service determines the castability of the design, figuring shrinkage factors, gating requirements and suggesting design changes necessary to achieve optimum results at minimum costs. The suggested changes are marked directly on the print which is returned to the designer for customer's acceptance of the changes and pattern fabrication.

When the customer and foundry have agreed on the design of the proposed part, the polystyrene pattern or patterns are prepared in accordance with the marked print. One polystyrene pattern is required for each individual casting desired since the pattern is expendable in the investment-casting process. Only pure polystyrene plastic is presently used as its characteristics have been found to be best for the casting process.

Simple designs may be machined from single pieces, while more complex designs can be broken down into their simplest components, each component being machined separately. The simple components can be assembled then into the complete, complex pattern by the use of plastic adhesive.

The completed pattern is shipped to the foundry where it is gated and used to prepare a mold by a ceramic investment shell process. In this process, the pattern is burned out of the mold at a temperature of 1800F, causing it to completely vaporize.

The prototype is then cast, using whatever material and process required to enable the designer to achieve his overall design objectives.

### Pattern and Prototype Costs

Pattern costs vary with the complexity of the pattern and are determined directly by the amount of machining required and the prevailing labor rate in the area in which it is fabricated. Often, the design engineer can fabricate his own pattern from sections cut from standard sheet and bar stock.

This method of prototype and pattern production was originally conceived by Robert Miller, President of Precision Metalsmiths, Inc., Cleveland, Ohio. The technique has been developed to the point where a special PMI Cast Prototype Service has been made available to customers.



## Mercury-Cycle Working Fluid Lubricates SNAP-I Hydrosphere Bearings

E. J. Stefanides, Central States Editor

Mercury-lubricated, hydrosphere bearings are used in the turbomachinery of the SNAP I Power Conversion System, a closed Rankine-cycle system which uses mercury as the working fluid.

The decision to use the mercury working fluid as the bearing lubricant was dictated by the specific requirements—long life and unattended operation in space environments with zero leakage and maximum reliability.

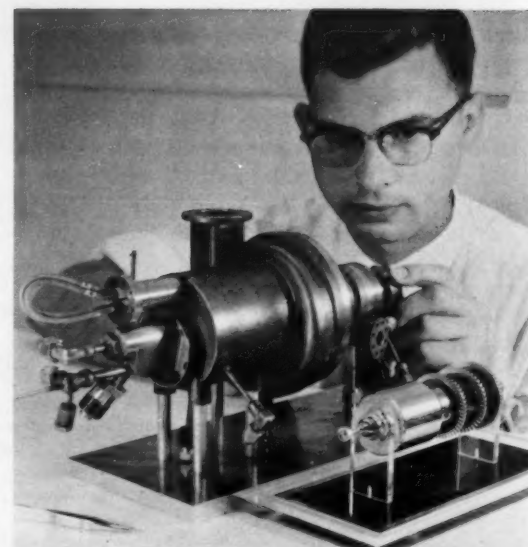
Conventional lubricants were eliminated from consideration because of high temperature, nuclear radiation, increased complexity of an additional lubrication system and the requirement that the working fluid be kept free of foreign-matter contamination.

Because of the lack of prior art, use of the system working fluid as the bearing lubricant presented

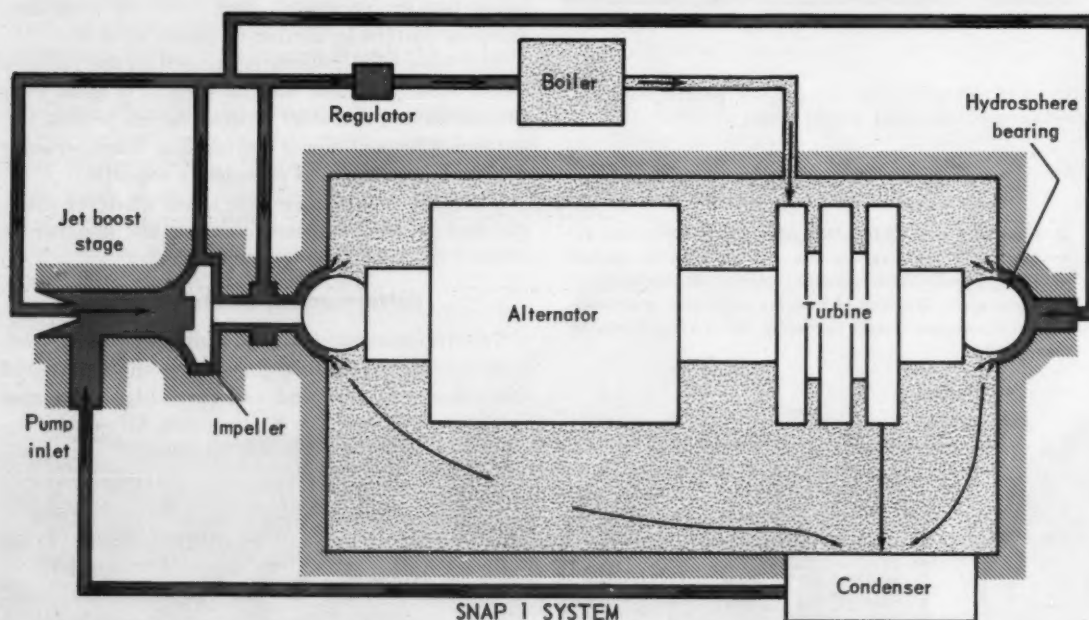
several problems. Corrosiveness or incompatibility of the lubricant materials presented the problem of contamination of the lubricant with its subsequent effect on bearing clearance and system integrity. A separate investigation was conducted in this area. It resulted in final selection of a high-speed tool steel for the bearing parts.

Other properties of the lubricant which complicated bearing selection and design were the ultralow viscosity of the lubricant at high temperatures; its high density which introduced inertia problems, and its nonwetting characteristics which prevented easy handling by the classical hydrodynamic equations. To evaluate these factors, analytical and empirical design procedures were developed and verified by experimental results.

The hydrosphere bearing was selected as the most



SNAP I TURBOMACHINERY PACKAGE consists of three-stage, axial-flow mercury-vapor turbine, radial-gap alternator and dual-purpose mercury pump for Rankine-cycle power-conversion system. Components are mounted on common shaft rotating at 40,000 rpm and supported by mercury-lubricated hydrosphere bearings. System is designed to deliver 500w continuously for 60-day period. In test, system has operated continuously on endurance in excess of this period and has logged total of 2510 hr without failure.

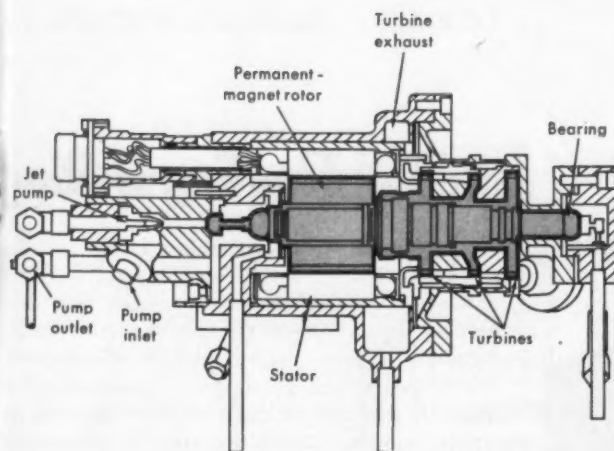


SNAP I SYSTEM is first of family of space power plants. Operating on closed Rankine cycle, system uses mercury as working fluid and bearing lubricant. It uses radioisotope as energy source to vaporize mercury in boiler. Subsequent SNAP II and Sunflower systems will use nuclear reactor and solar-energy collector device to vaporize mercury. Addition of jet-boost

stage on centrifugal pump increased maximum pump capacity from 10 lb per min at 300 psi to 15 lb per min at 400 psi. Increase is achieved by boosting pump inlet pressure from 1.9 to 9 psia. Increased inlet pressure also eliminates cavitation effects which occur below 2.5 psia inlet pressure.

promising bearing to satisfy the specifications. Primary considerations in its selection were reliability, low power loss, adequate radial and thrust-load capacities and minimum lubricant flow requirements. In addition, the hydrosphere bearing is insensitive to misalignment resulting from residual housing strains and unequal thermal distribution. It has high-speed stability because of its small radial clearance.

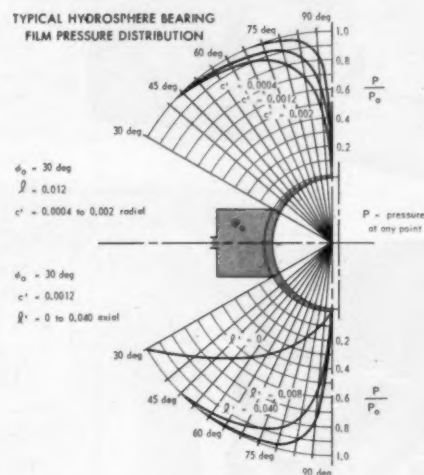
A disadvantage of the hydrosphere is the precision machining requirements of its three-dimensional fabrication. In addition, it also requires provision to increase the bearing-socket pressure under increasing axial load. Otherwise, the bearing will collapse, shutting off lubricant flow and resulting in bearing seizure. In this design this is accomplished by restrictive orifices in the bearing inlet lines. The sys-



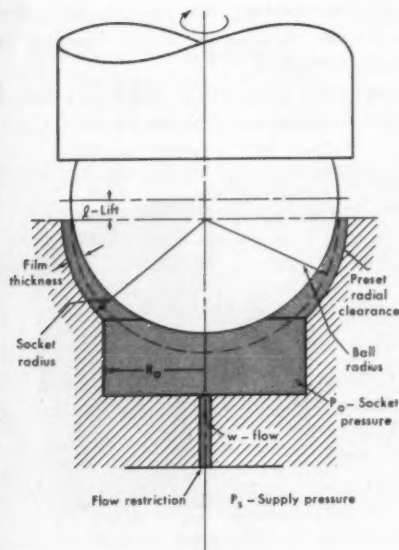
SECTION THROUGH TURBO MACHINERY PACKAGE shows arrangement of components on common shaft, supported on each end by hydro-sphere bearings. Pump is required to operate at high speed, producing high head with low flow from very low inlet pressures. Pump is jet-boosted centrifugal design with four-vane, radial-flow open impeller.

tem then becomes a dual-orifice system which automatically increases bearing pressure as the bearing sphere approaches the socket under increasing load.

These hydro-sphere bearings, and the turbo machinery in which they are used, were developed by The New Devices Laboratories, Tapco Group, Thompson Ramo Wooldridge, Inc., Cleveland, Ohio, for the SNAP I power conversion system. The program is sponsored by the Atomic Energy Commission. The prime contractor of the SNAP I program is the Martin Co., Baltimore, Md.



TYPICAL FILM-PRESSURE DISTRIBUTION shows that major portion of pressure drop in bearing occurs within 15 deg of equator. Upper curves are based on constant axial-lift ratio and varying initial radial clearance. As radial clearance increases, greater pressure drop is taken near equator because of greater decrease in effective flow area at equator. Lower curves are for constant radial clearance, varying axial lift. Because minimum flow area is at equator and clearances near inlet are larger, increasing lift moves pressure distribution curve closer to equator.



HYDROSPHERE BEARING consists of spherical journal rotating in nongrooved hemispherical socket of slightly larger diameter. Lubricant-film geometry is function of difference in ball and socket radii and axial displacement between their centers. Film is crescent-shaped in any plane through axis of rotation. Flow restriction in base of socket makes bearing essentially a dual orifice system with flow, socket pressure and axial load capacities being linear functions of lift. Thus, movement of bearing sphere toward socket increases socket pressure, compensating for load increase and preventing collapse of bearing.

*This Emblem*

**ANCHOR**  
THE PLEDGE OF PERFORMANCE

*is*

**COMPLETE RELIABILITY**

*in Hydraulic Transmission Lines*

When stamped on Anchor hydraulic components . . . the Anchor emblem is your definite assurance of constant, uniform quality in design, engineering and manufacture . . . and *complete reliability* in hydraulic transmission lines. Anchor fluid power components eliminate equipment downtime . . . production delays . . . idle manpower.

Anchor's comprehensive line of Hydraulic Hose Assemblies with Pressed-On, Reusable, Clamp-Type or 4-Bolt Split-Flange "O" Ring Head Cou-

plings . . . Hydraulic Hose . . . Adapters, Adapter Unions, Pipe Fittings, and SAE Boss Fittings with the greatest variety of thread combinations — pipe, J.I.C., SAE — give long life, uninterrupted trouble-free service . . . with minimum maintenance.

Today . . . as it has been for over 20 years . . . Anchor is *first choice* among original equipment manufacturers.

Send for the Condensed Catalog . . . to help you choose the *right* Anchor hydraulic component for your equipment.

**ANCHOR HOSE ASSEMBLIES** with Pressed-On Couplings for maximum working pressures from 12,500 PSI to 100 PSI.

**ANCHOR REUSABLE, CLAMP-TYPE, DULOC and/or HOLD-FAST COUPLINGS** for pressures from 5000 PSI to 100 PSI.

**ANCHOR 4-BOLT SPLIT-FLANGE "O" RING HEAD COUPLINGS** for pressures from 3500 PSI to 100 PSI.

**ANCHOR ADAPTERS, ADAPTER UNIONS, PIPE FITTINGS, SAE BOSS TYPE FITTINGS** in variety of styles and sizes, and thread combinations.



Andy Anchor says: "Remember . . . the Anchor emblem is our 'Pledge of Performance'. . . always! You increase the saleability of your equipment with Anchor fluid power components."

**ANCHOR Coupling Co. Inc.**

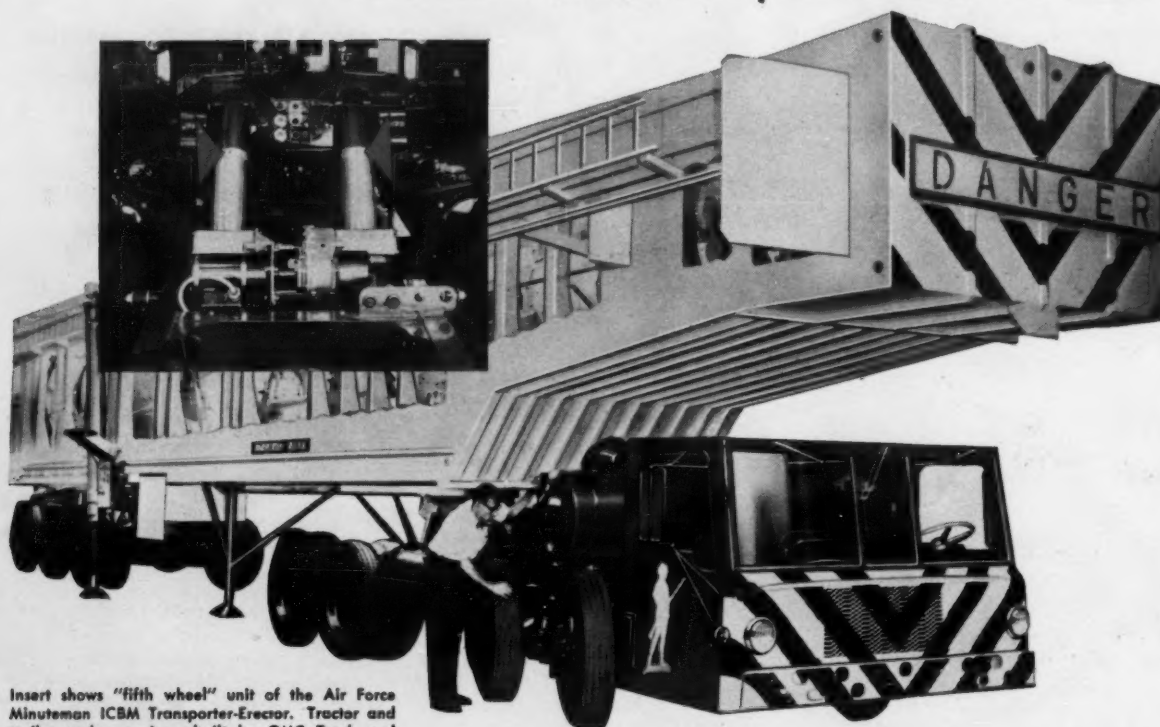
320 North Fourth Street, Libertyville, Ill.  
Branch Plants: Dallas, Tex., Plymouth, Mich.

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# Hefting a Heavyweight

...A SNAP with  
**SAGINAW b/b SCREWS**



Insert shows "fifth wheel" unit of the Air Force Minuteman ICBM Transporter-Erector. Tractor and trailer under carriage built by GMC Truck and Coach Division.

Low-friction Saginaw Ball Bearing Screws allow a small electric motor in the "fifth wheel" unit to rapidly raise and lower the forward end of this transporter of a 65,000 pound missile... allows the transporter to pass under highway overpasses and other low clearance obstacles en-route to underground launching sites.

Also, Saginaw b/b Screws are used for leveling jacks on the rear sides of the carriage unit. The effort required to level the undercarriage is so small the jacks are hand-operated. Each of the jacks has a capacity of 65,000 pounds.

The efficiency of Saginaw Ball Bearing Screws and Splines is being used by designers of today's space, air and ground handling systems. They can lower operating costs, reduce maintenance and simplify designs. And they often reduce installation costs. Whatever your application problem, call on Saginaw to help solve it with Saginaw b/b Screws! Saginaw Steering Gear Division, General Motors Corp., Saginaw, Michigan—world's largest producers of b/b screws and splines.

WRITE TODAY FOR NEW 1961 ENGINEERING DATA BOOK OR REFER TO SWEET'S DESIGN FILE

**Saginaw**  **Screw**

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## IDEAS...MECHANICAL

### Floating O-Ring

Edward W. Schrader, Western Editor

A floating O-ring seals ferrite powder in a dry-particle clutch. The driver section of the clutch consists of a gear attached to a rotary solenoid. Slip rings transmit power to the solenoid. The magnetic structure of the solenoid terminates in a radial air gap. This air gap contains a quantity of ferrous powder, which packs to a tightness proportional to the control current supplied. Torque output of the clutch is almost linear with current excitation.

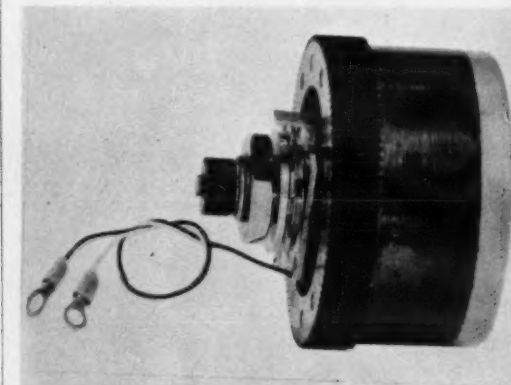
In the powder-filled gap is a cup-shaped member affixed to the output shaft. As the solenoid rotates, the magnetized iron powder in the rotating air gap tends to pull the output cup and shaft with a torque.

A single, stationary, sintered-bronze bearing supports both the driving solenoid and the driven shaft. It acts also as the main clutch support and as a heat transfer medium. The stationary bearing is fixed to the mounting panel.

The output shaft rotates within the stationary bearing. The design is arranged to require only a single sealing point between the two rotating members since the stationary bearing is outboard of the seal.

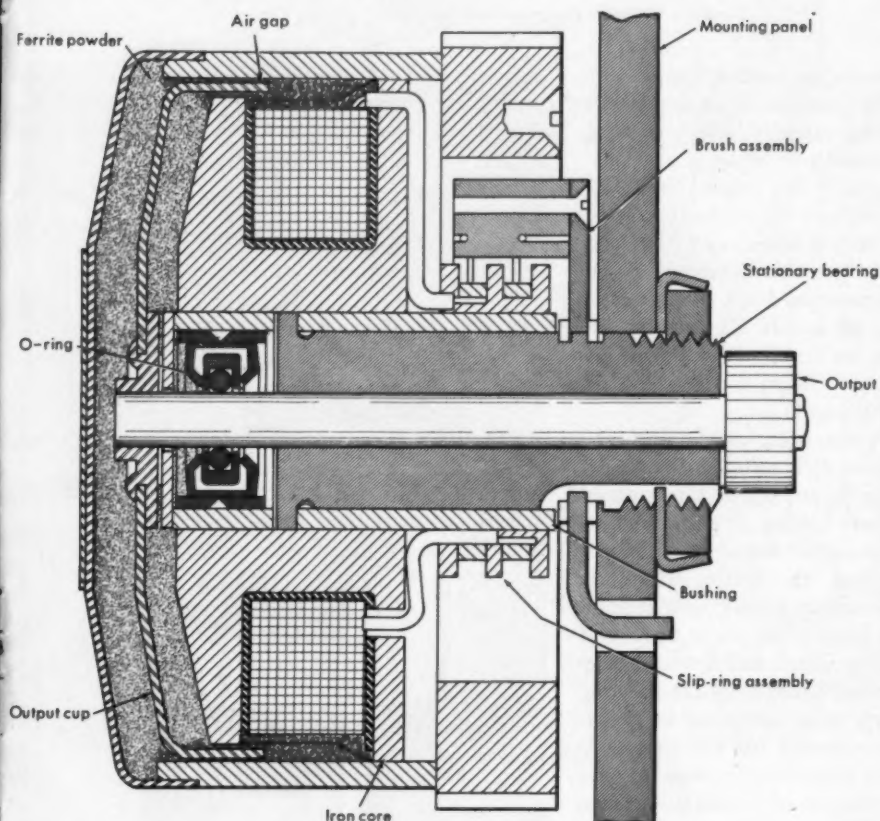
Centrifugal force inherently throws most of the ferrite powder away from the seal. A "Teflon" retainer supports the O-ring seal. Because the O-ring is free to float within its retainer, the seal is capable of compensating for any eccentricities which may occur because of torque loading or misalignment tolerance.

The Model 3002 dry-particle clutch is a design development of Force, Ltd., Santa Monica, Calif.



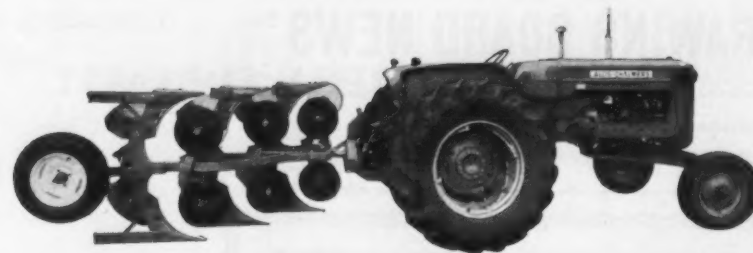
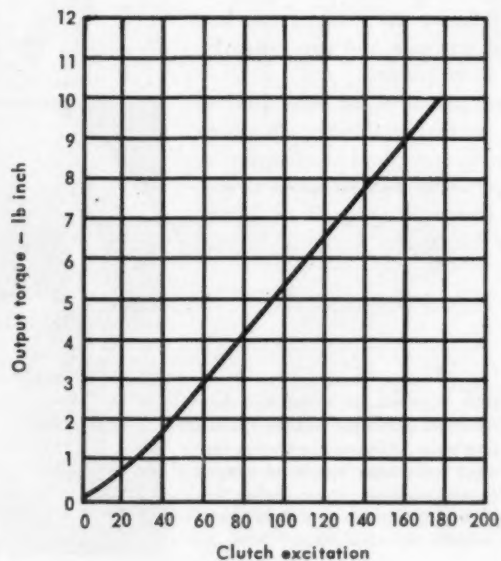


## Seals Dry-Particle Clutch

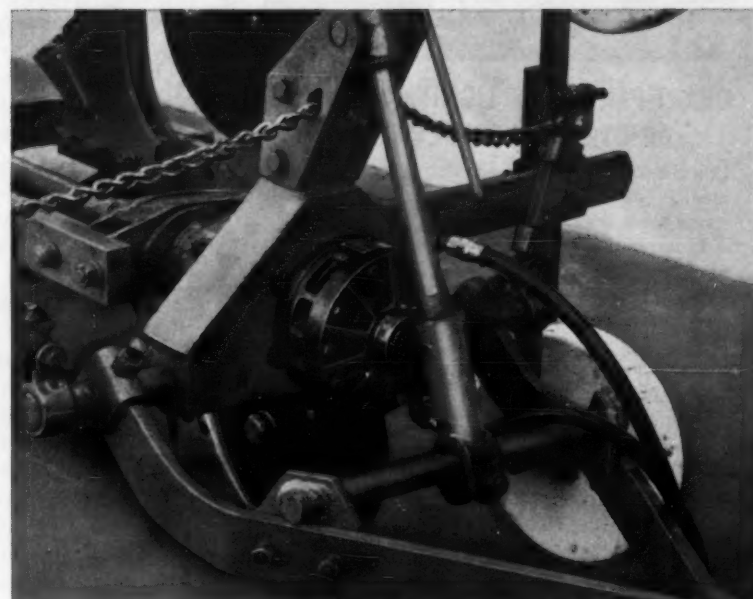


**OUTPUT TORQUE** is proportional to control current. Torque curve is unchanged by clutch speed. Maximum normal speed is 1800 rpm. Linear torque curve makes device suitable for either clutch or brake operation in servomechanisms.

**MAGNETIC PARTICLE CLUTCH** offers high heat dissipation because of solid quill bearing. Vaporproof rotary seal is designed for 3 million cycles or 1000 hours of operation. Maximum drag of clutch with no excitation is 5 oz-in.



## New Allis-Chalmers spinner plow actuated by Houdaille's HydRoAc



Houdaille's versatile new HydRoAc Rotary Actuators found immediate application on this Two-way Moldboard Plow built by Allis-Chalmers. Mounted on the end of the rotatable plow shaft, the HydRoAc unit provides a compact, efficient method of "spinning" the plow bottoms at the end of each furrow.

You'll find there's a HydRoAc unit to fit almost every commercial application where hydraulic power must be converted to rotary motion. Five different sizes, from the Tiny 16 lb. unit to the 1,100 lb. unit, with 20 variations in each size, add up to 100 separate units to choose from. Efficiencies are high... up to 95% or over. Torque range from 1500 to 741,000 in. lbs. at 3000 p.s.i. Discover now why Allis-Chalmers selected Houdaille's HydRoAc. Send in coupon below for free catalog.

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**Houdaille Industries, Inc.**

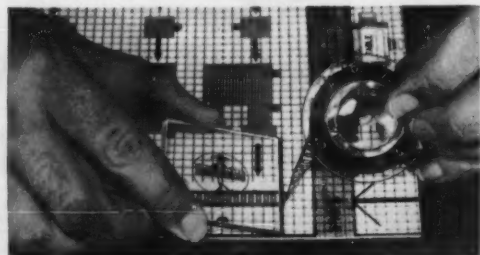
... specialists in rotary type hydraulic equipment

Buffalo Hydraulics Division, Dept. A, 537 E. Delavan Avenue, Buffalo 11, N. Y.

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# DRAWING BOARD NEWS<sup>No. 2</sup>

Published by Chart-Pak, Inc., originator  
of the tape method of drafting

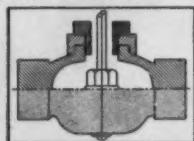


## CHART-PAK TAPES LIGHTEN THE LOAD OF OVERWORKED DRAFTSMEN

Chart-Pak is good news for designers and draftsmen. It cuts down on routine "pencil pushing." It leaves more time for creative work.

Lines, bars, shapes, patterns and symbols don't have to be drawn. With Chart-Pak, they come on pressure-sensitive tapes and sheets. They just *press* down . . . quickly, neatly.

Even curved lines, as small as  $\frac{1}{64}$ " wide can be "taped" on. And Chart-Pak is "goof-proof," too. It is easily lifted and moved . . . yet won't come off accidentally.



## Chart-Pak Shading Films stick without burnishing — won't skid

Chart-Pak shading films have a water-clear adhesive that sticks tightly to tracing cloth or paper with light pressure . . . without laborious rubbing down. They are also "skid-proof," even in hot reproduction machines. More than 100 patterns and 27 color tints available, on DuPont "Mylar" . . . printed in black or white.

## PRE-PRINTED TITLE BLOCKS SAVE WORK

Draftsmen save work on every drawing, with "press-down" title blocks from Chart-Pak. Available printed to order—to read "right" or "reverse"—on clear or matte film. Quotations furnished on request.

DESIGNED BY	DATE	PROJECT
DRAWN BY	DATE	PROJECT
CHECKED BY	DATE	PROJECT
<b>CHART-PAK, Inc.</b> Leeds, Massachusetts		



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PACKAGE

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take the drudgery out of drafting!

**CHART-PAK, INC.**

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## IDEAS... MECHANICAL

## Cam Mechanisms, Electronic Sensor Automate Balance Operation

Toyotaro Yamada, Correspondent in Japan

A series of cam mechanisms for loading and unloading weights, as sensed by phototransistor system in a balance machiner of 100g capacity, allows an accurate seven-digit measurement in 30 sec.

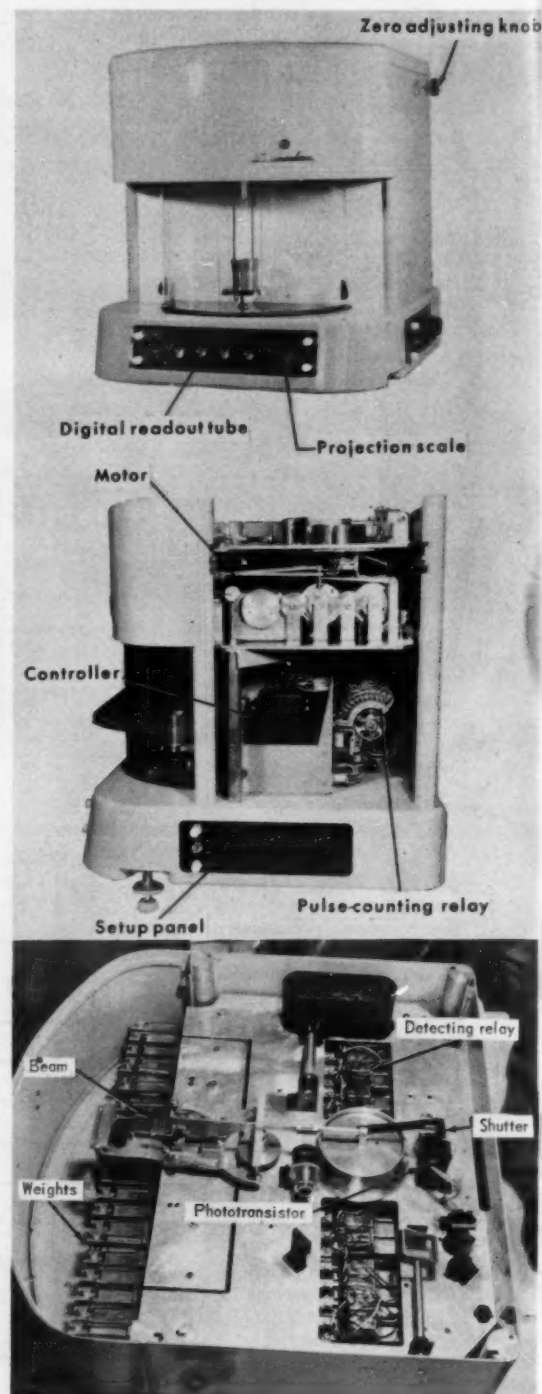
The total weight used in the balance is 100.2g, consisting of 50g, 20g, 10g and 10g in the 10-g series; 5g, 2g, 1g and 1g in the 1-g series, and 0.5g, 0.4g, 0.2g and 0.1g in the 0.1-g series. Procedure is: (1) all preceding weights mentioned are used and set to balance with beam; (2) sample is loaded on side of weights; (3) weights are removed one by one until perfect balance between beam and sample with remaining weights is obtained.

This is performed by unloading weights from the heavier to lighter in each digit series. Unloading is accomplished by lifting weight 0.5 to 1 mm above the weight hooking bar. Lifting is performed by cams driven by a constant-speed motor. The moment a certain weight is lifted, the sensor determines which is heavier, the beam or sample, with remaining weights. When the beam is heavier, it moves and a phototransistor receives signal and activates magnet relay to return the once-lifted weight to the original lever. When sample with remaining weights is heavier, the beam is not moved and the phototransistor receives no signal. Digits smaller than 0.1g are determined by the inclination of the beam and read by a projection scale. The particular cam for that weight removed is designed to give a corresponding number of pulses to the weight. If the weights removed are 0.5g and 0.2g in the 0.1-g series, five pulses are generated by one cam and two pulses by another cam, totaling seven pulses.

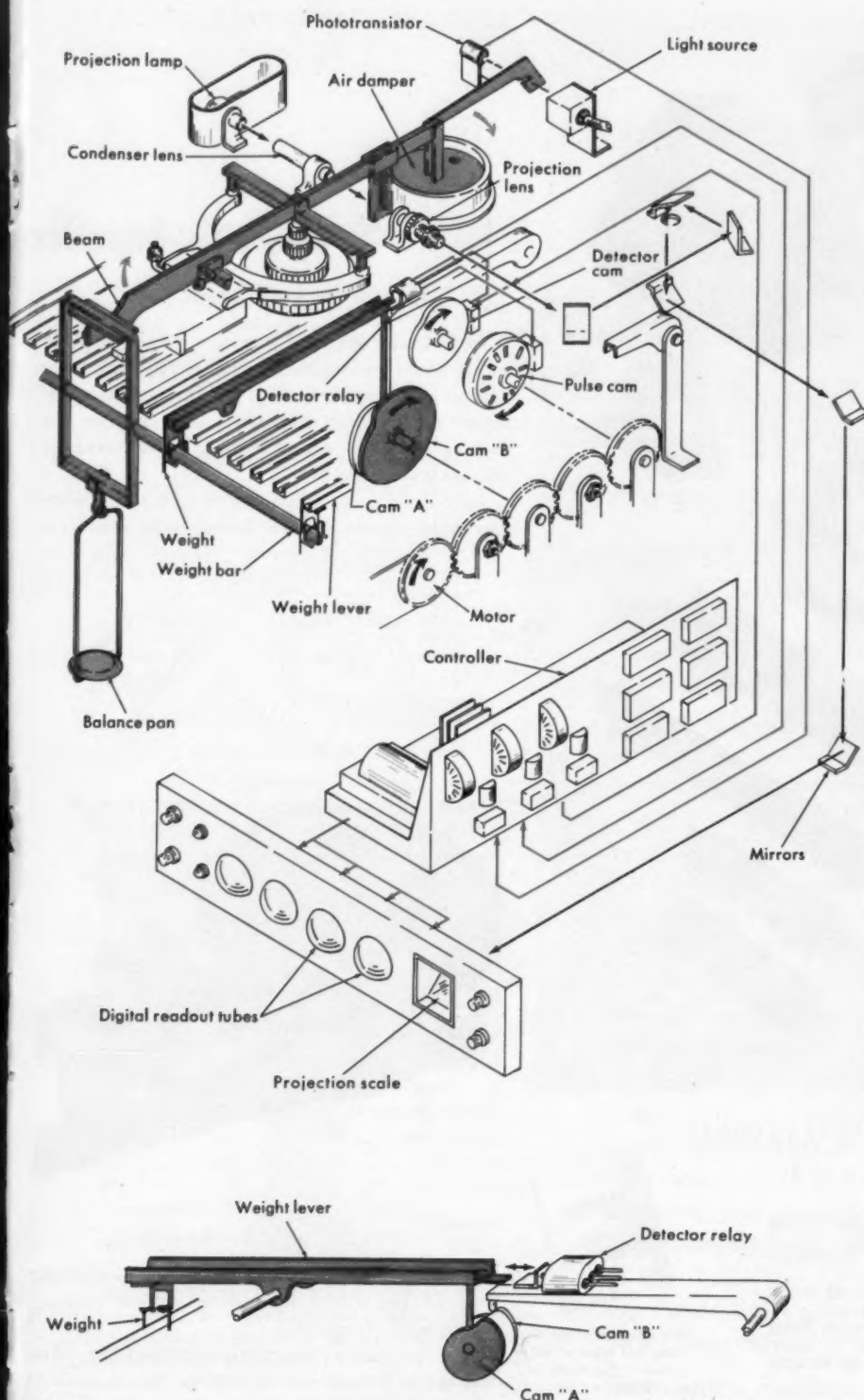
Auxiliary weights are provided for each digit to give correct judgment on marginal cases. This is to eliminate misjudgment by speed and acceleration of movement; for instance, 79.9g may be taken as 80g.

The automatic balance was designed by Hideo Mishima of Shimadzu Seisakusho, Kyoto, Japan.

OPERATION is generally initiated by using four buttons on front panel. Two start and reset buttons on left side are used to check zero point. Two start and reset buttons on right side are used to measure weight of sample. Sampling also can be accomplished on preset weight. Normal readout is by digital readout tube and scale; type-written readout can be added.



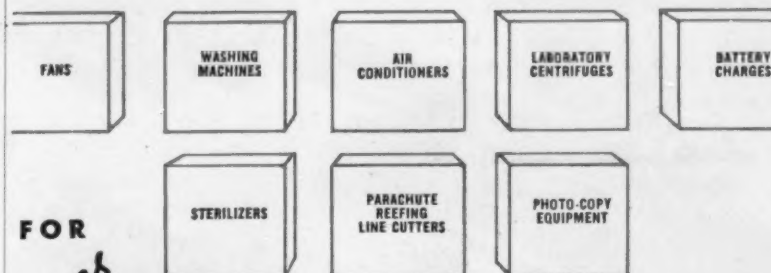




UNLOADING AND RELOADING of weight is made by cam A, cam B and detecting relay. When weight lever drops into recess of cam A, weight is lifted by tension spring. Unloading of weight then is made automatically by programming of cams which have shifted phases, for instance, in sequence of 5-2-1-1. When beam moves,

phototransistor activates detecting relay to make contact with lever. Relay unit is lifted by cam B to reload weight. Electrical function of relay is to switch pulse circuit on and off. When signal is not received, pulse circuit is connected and sends pulses corresponding to weight. When signal is received, pulse circuit is disconnected.

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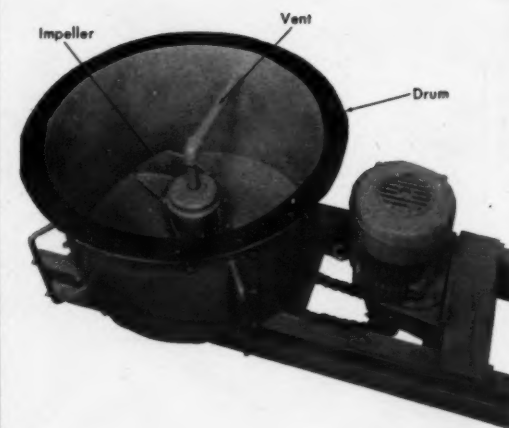


## Feeder's Impeller

Victor W. Wigotsky, Eastern Editor

A bulk feeder includes a vertical blade impeller to de-aerate pulverized materials. The impeller acts on the head pressure in the storage bin to de-aerate the material through a vent. Design also assures smooth continuous flow by agitation at the bottom of the bin.

De-aeration can significantly save space when pulverized materials are loaded into drums or



containers. Amount of de-aeration is essentially proportional to the increase of vertical pressure in the head of material.

The two-bladed impeller compresses the material at the bottom of the storage bin as it flows toward the discharge orifice. De-aeration is constantly taking place through the material in the effective vertical head area. Impeller rotates at a low speed and develops a centripetal-force to induce discharge through a central feed-tube orifice.

The bulk feeder and de-aerator is designed by VertiVeyor Co., Paterson, N. J.



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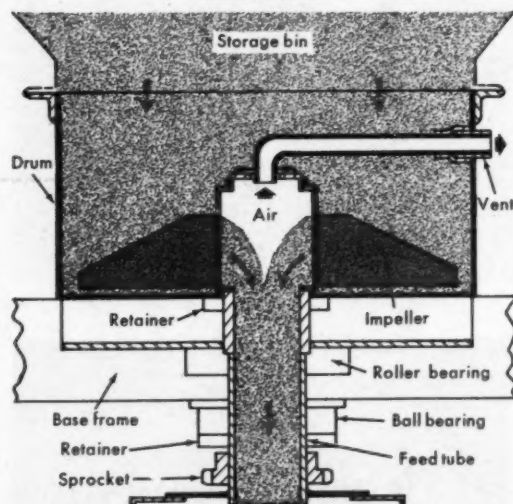
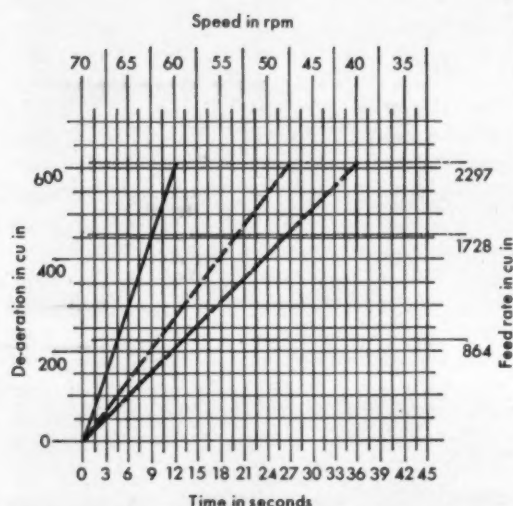
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**QUALITY AIR CONTROL PRODUCTS**

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## De-aerates Bulk Material



**FEEDER MOVES MATERIAL** under compression and combines action of a vortex. Simple addition of impeller nets space saving for material to be packaged. Application of de-aeration principle enabled 70 lb of material (sodium acetate) to be placed in a 50-lb bag. Design provides constant-feed pattern with changes in impeller speed and feed-cycle time. Graph illustrates that while 2908 cu in of material were displaced from a drum while operating at impeller speed of 60 rpm, only 2297 cu in of material were contained in receiver. Thus, during 12-sec feed cycle, de-aeration equalled 611 cu in. When speed was reduced to 40 rpm and feed cycle increased to 36 sec, de-aeration also equalled approximately 611 cu in.

## Designing a machine?

Let your local Gates Engineer Prove Super HC Drives save space, weight, money

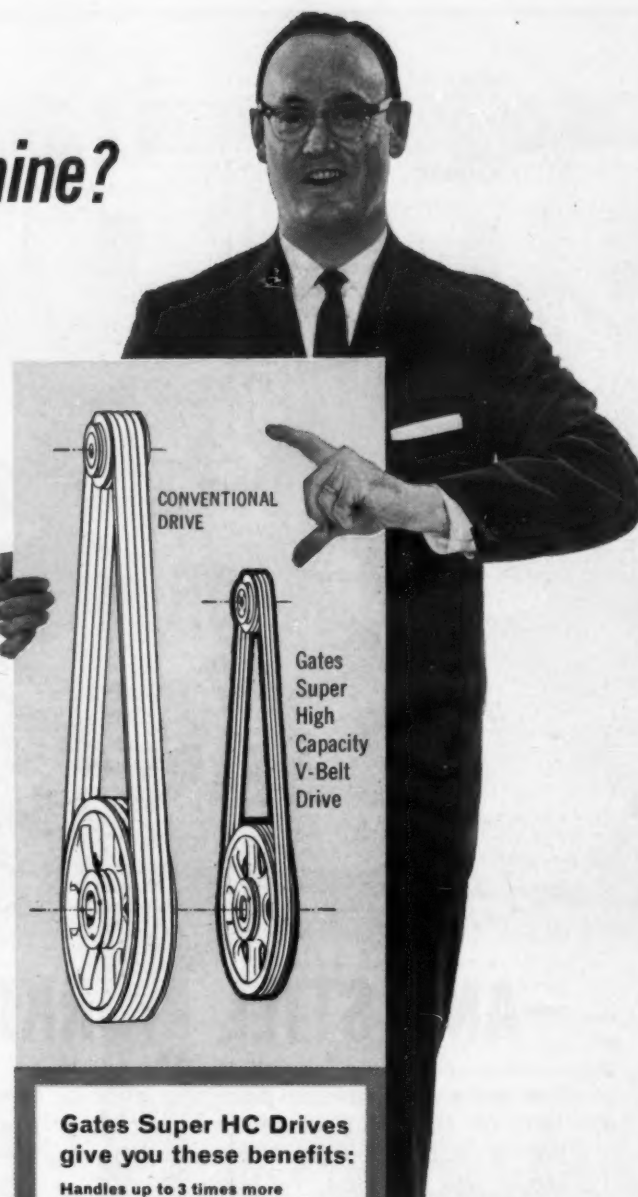
If you are designing a new machine or re-designing one for better performance, your local Gates Field Engineer will be glad to help you. He can show you how to take full advantage of the many opportunities offered by Gates Super HC High Capacity Drives.

Ask him to design a drive for your machine two ways: a conventional V-belt drive and a new Gates Super HC High Capacity V-Belt Drive. A quick comparison will show you many of the important savings provided by the new Gates drive.

Manufacturers everywhere have standardized upon the Gates Super HC V-Belt Drive—industry's first and most advanced high capacity drive. It is your best assurance that your power transmission unit will not soon become obsolete.

*Your local Gates Field Engineer is an experienced, fully-qualified drive design expert. Contact him for drive design help.*

The Gates Rubber Company  
Denver, Colorado



### Gates Super HC Drives give you these benefits:

- Handles up to 3 times more horsepower than conventional V-belts in the same space.
- Saves up to 50% in drive space.
- Reduces drive weight 20% and more.
- Cuts drive costs as much as 20%.
- Reduces bearing load, increasing bearing life.
- Guards and machine housings can be smaller, lighter weight.
- Belt speed up to 6000 ft/min possible without dynamic balancing.
- Less costly, higher speed motors can often be used.

#### Exclusive design features include:

- precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Building the future on 50 years of progress



# Gates Super HC V-Belt Drives

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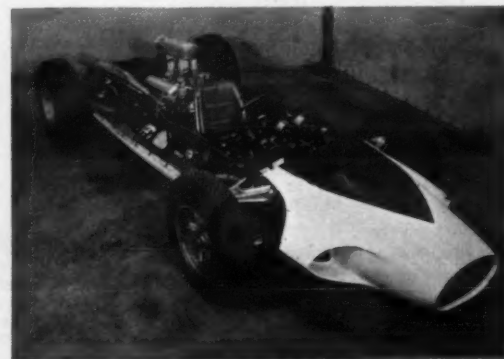
## Rear Axle Driveshafts

Robert L. Candlish, Detroit Editor

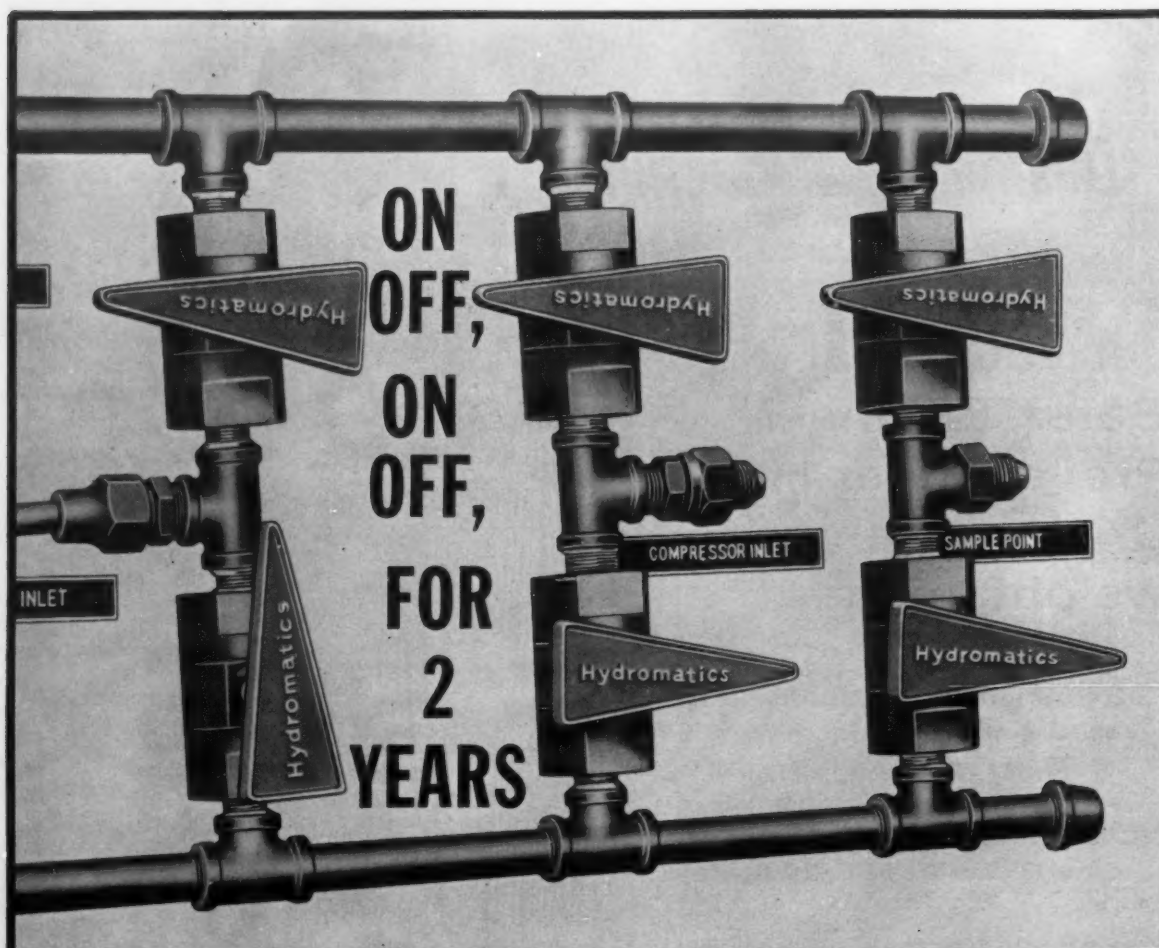
Fixed-length, double universal-joint rear-axle half shafts serve as upper control links in the independent rear-suspension system of a research vehicle built for investigation of ride and handling phenomena. The half shafts are compression members in the two-link system controlling wheel-vertical motion. A third link from the frame to the wheel hub maintains wheel fore and aft position and absorbs wheel thrust in driving and braking. Driving and braking torque reactions are transmitted directly to the chassis through the differential housing and engine mounts.

All four wheels are suspended independently to provide a high order of stability and positive handling. To amplify vehicle responses to handling and road stimuli, performance capability of the vehicle was extended far beyond that of regular passenger cars by a substantial increase of the power-to-weight ratio. Suspension phenomena that are extremely subtle may be studied and treated quantitatively on this test platform. Wheels are not enclosed and all are visible to the driver. Longitudinal fuel tanks maintain fore and aft weight distribution during testing.

The "CERV-I" (Chevrolet Engineering Research Vehicle) was built at the Chevrolet Engineering Center, Warren, Mich., in a special project headed by Zora Arkus-Duntov, Chevrolet staff engineer and noted designer and driver.



INDEPENDENT FRONT SUSPENSION has high roll center, uses variable-rate coil springs and shock absorbers plus 11/16-inch interconnecting stabilizing bar. Overall steering ratio is 13.5:1, requiring 2 1/4 turns from lock to lock.



## —AND STILL WORKING PERFECTLY!

Two years ago a leading processing plant installed FLO-BALL valves in lines controlling media at 3,000 psi. Previous longevity record was 3 months. Yet today, after 24 months of constant operation, the original FLO-BALL valves are still going strong — without a single breakdown!

Here are the facts on the Series 715 FLO-BALL Valves. It opens and closes with a fast quarter turn and its arrow shaped

handle provides positive on-off indication at a glance. The FLO-BALL acts instantly at flow pressures from vacuum to 3,000 with low, low torque. And its exclusive design offers 100% flow efficiency — plus: zero leakage, universal mounting, removable flanges, all stainless steel construction. The non-metallic handle cannot conduct heat or cold to operator's hand. Short turning radius makes it ideal for panel mounting in close quarters. Yet the FLO-BALL costs no more!

Write today for complete information on Series 715 FLO-BALL in sizes from 1/8" to 1/2".

# Hydromatics, Inc.

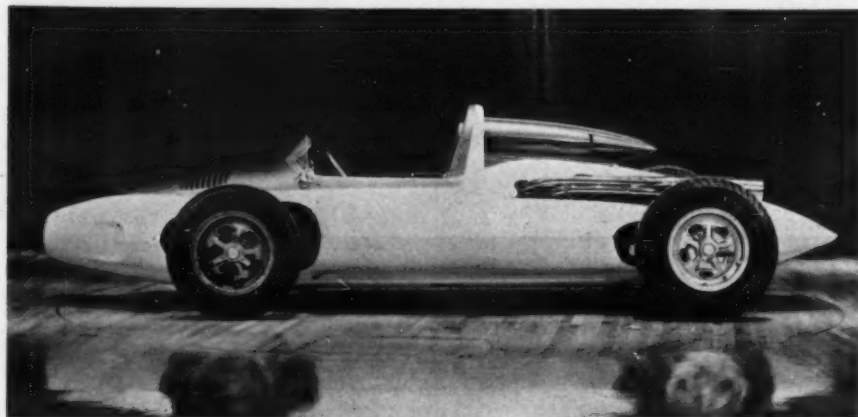
BLOOMFIELD, N. J. • PILGRIM 8-7000 • TWX = BLOOMFIELD, N. J. 120

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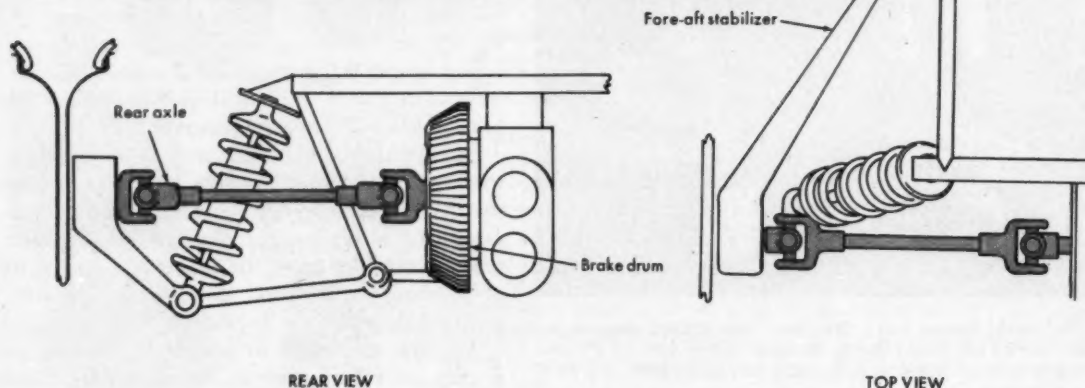
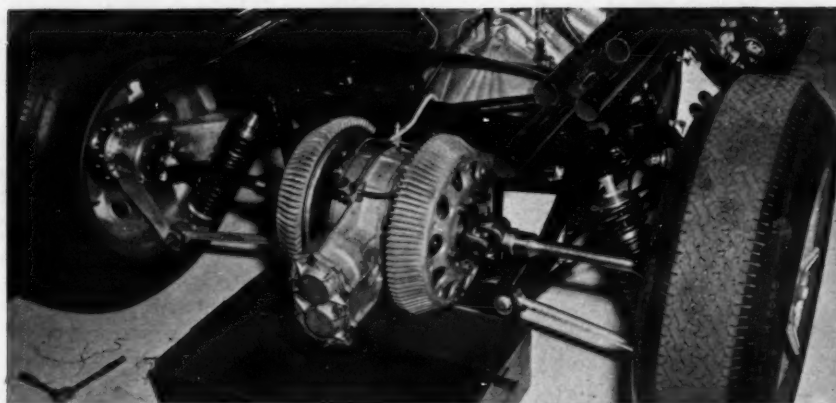


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## Double as Suspension Links in Research Car



**GLASSFIBER-REINFORCED PLASTIC BODY** weighs approximately 80 lb and fully encloses car underside.



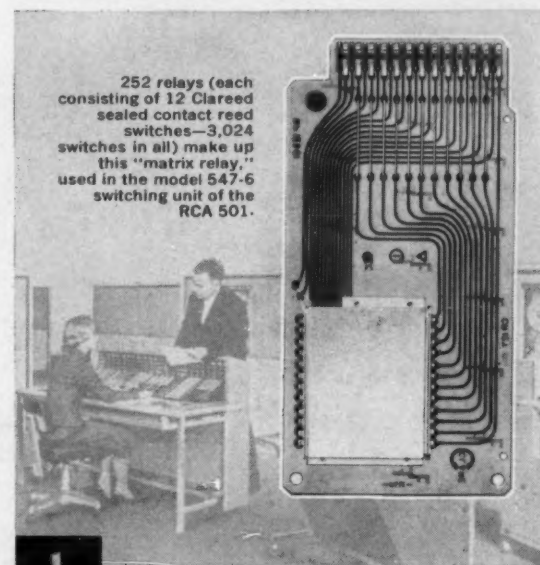
**EACH REAR-WHEEL STUB AXLE** is mounted rigidly in precision bearing in control arm that absorbs compression load on axle shaft. Bracket extending down from trailing arm retains lower end of variable-rate coil spring and outboard end of lower suspension-control linkage. Variable-rate coil

springs, unitized with direct double-action shock absorbers, are mounted diagonally at each rear wheel. Both wheel camber and toe-in are adjustable: camber by eccentric bushings holding the inboard end of lower suspension links, toe-in by side shims at mounting of trailing arm to frame.

## RCA uses 252 CLARE

Printed Circuit Relays in the 501 electronic data processing system

RCA's 501 incorporates many advanced features which significantly increase reliability as well as economy of space, weight and power.



252 relays (each consisting of 12 Clareed sealed contact reed switches—3,024 switches in all) make up this "matrix relay," used in the model 547-6 switching unit of the RCA 501.

### CLAREED Sealed Contact Relays provide fast, sure switching

Contributing to the efficiency, speed and compact structure of the RCA 501 are 252 CLAREED sealed contact reed relays. These relays, their contacts hermetically sealed in contaminant-free inert gas, assure millions of perfect operations... hundreds of millions when operated at up to  $\frac{1}{2}$  rated load. Low inductance, and the low inductance change at each operation, limits the transients produced.

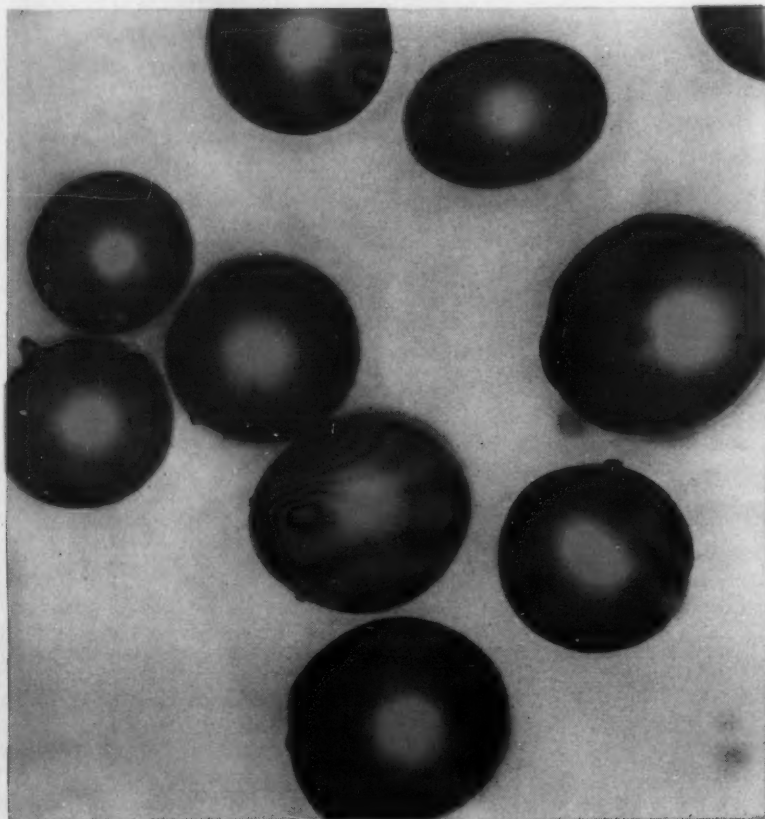
These relays may be mounted to meet almost any requirement. Consult your nearby CLARE sales engineer...or write: C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: C. P. Clare Canada Ltd., 840 Caledonia Road, Toronto 19, Ontario. Cable Address: CLARELAY. Ask for Bulletin CPC-10.



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# 30 MILLION OF THESE JET-FORMED SPHERES IN EVERY INCH OF BEARING SURFACE!



**JET PROCESS BLASTS MOLTEN ALLOY INTO UNIFORM PARTICLES** . . . so small that thirty million will form a thin layer only one inch square! This sintered layer is the bearing surface of Federal-Mogul sleeve bearings.

Molten copper-lead, alloyed to exact specifications, is poured into a special inert-atmosphere reaction crucible. Here it's blasted by a high-speed fluid jet to form the dense powder shown at left.

Because of the uniform particle size of this powder, the bearing surface of each F-M copper-lead sleeve bearing has precisely the same alloy composition and high adhesion to the steel backing as every other F-M bearing of the same alloy type!

**YOU CAN SEE THE CONSISTENT SIZE** in the photomicrograph. What you *can't* see is the consistent alloy composition which produces uniform bearing properties and performance in any alloy type.

Federal-Mogul makes engine bearings for every condition of speed and load. You can select from among five different sintered copper-lead alloys, all permanently bonded to precision-formed steel backing. Our Engineering Department is available to you for consultation or recommendations on bearing design and application. For more information, write Federal-Mogul Division, 11055 Shoemaker, Detroit 13, Michigan.



**A COMPLETE LINE!** Steel backed bearings with a selection of many different alloys for virtually any bearing application—Plain and bimetal bushings in bronze, steel or aluminum. Precision thrust washers in solid bronze, or sintered alloys on steel (one or both faces). Rolled split spacer tubes in steel, aluminum or stainless.

## FEDERAL-MOGUL

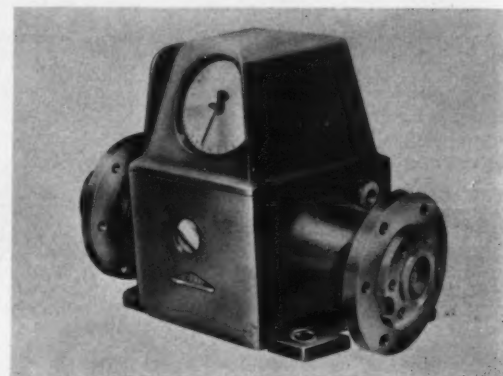
sleeve bearings  
bushings spacers  
thrust washers

DIVISION OF  
FEDERAL-MOGUL-BOWER  
BEARINGS, INC.

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IDEAS...MECHANICAL

## Epicyclic Gears Magnify



Epicyclic gear systems magnify twist in a torsion bar under load to give a continuous reading of prime mover output. Simple and compact, the new torque meter accurately measures from zero to 850 lb/ft in a speed range of 0-25,000 rpm with negligible power consumption.

All power is transmitted by the torsion bar whose ends are splined to engage two coupling shafts. These shafts have flanged ends for installation in the drive.

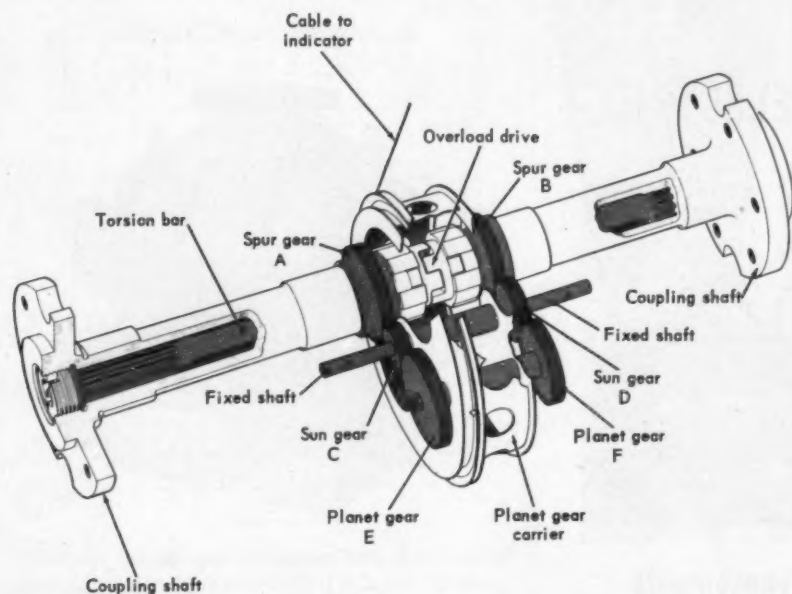
Spur gears mounted at the inner ends of each coupling shaft mesh with sun gears of the two epicyclic gear trains. These sun gears rotate freely on fixed shafts. Two planet gears are mounted on a common shaft that rotates in a carrier, pivot-mounted on the fixed shafts of the sun gears. A flexible wire cable secured at one end to this carrier is coupled to the drum of a dial-type indicator. The dial is graduated in lb/ft within the limit of elastic twist of the torsion bar.

Applied torque twists the torsion bar, giving a relative angular displacement to the coupling shafts and consequently to the spur gears. Displacement is transmitted through the epicyclic gear trains which cause the planet-gear carrier to pivot about its axis and thus rotate the cable-actuated drum on the indicator.

To prevent damage in case of overloading or torsion bar failure, dogs on the inner ends of the coupling shafts come into contact after a few degrees of rotatable movement to maintain drive.

Designated TMR-3, the mechanical torque meter is designed and manufactured by Sir George Godfrey and Partners, Ltd., Hanworth England.

## Torsion Bar Twist for Continuous Torque Reading



**PLANET CARRIER** is stationary at constant torque and spur gears A and B have same speeds because gear ratios A:E and F:B are both unity. When torque is applied to torsion bar, corresponding twist appears as an angular displacement of spur gear A relative to spur gear B. Considering spur gear B and sun gear D as fixed, speed ratio between spur gears will give magnification of twist.

FOR YOUR PRECISION AND SPECIAL GEARING REQUIREMENTS... LOOK TO **Arch**



PRECISION GEARS



STANDARD GEARS



GEAR ASSEMBLIES



CUSTOM DIFFERENTIALS

IN **PRECISION GEARING** Arch Gear offers you a thoroughly skilled group of gear specialists operating the latest in gear cutting and processing equipment to produce to your specifications all types and classes of precision gears at low unit costs . . . . .

IN **STANDARD GEARS**, the facilities of Arch Gear are perfectly suited to augment your organization in the production of large commercial gears or close tolerance manufacture of special production-type precision gears . . . . .

**CUSTOM DIFFERENTIALS** are a product of Arch Instrument, a separate manufacturing entity devoted to meeting the needs for space-age tolerances. With ten models from 1/16" to 5/16" in both hollow and solid shaft units, Arch offers you the most advanced line of differentials available. Assembly, testing, calibration and packaging is performed in a specially constructed white room to assure specified tolerances and performance.

IN **GEAR ASSEMBLIES**, another specialty of Arch Instrument, we offer you complete design and engineering assistance on gear trains and other servo gear assemblies. From a pilot model to a large number of production units, Arch is equipped to produce to exacting specifications as well as perform the assembly and testing of the complete electro-mechanical package . . . . .

Why not investigate the gearing abilities of Arch? Write for complete information and literature today . . . . .

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97 HOLMES STREET, NORTH QUINCY 71, MASS.  
**ARCH INSTRUMENT CO., INC.**  
101 HOLMES STREET, NORTH QUINCY 71, MASS.

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DESIGN NEWS—MAY 8, 1961



## AIRMATIC MINIATURE AIR CYLINDERS

*compact, space-saving  
and easily installed*

Wherever space is at a premium, Airmatic Miniature Air Cylinders are today's number one selection for aiding in dependable, maintenance-free automation.

For activating electrical contacts in test jigs and fixtures—as miniature air vices—in automatic work for feeding, ejecting, soldering and many other applications. In fact, applications are limited only by the ingenuity of industry's design and production engineers.

Shown here, for example, is Airmatic No. C-1125 mounted on the gravity feed chute of a vibrating parts feeder.

The complete miniature line (with bores of 3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2" and 2") are designed with thick brass tube walls.

Airmatic products lead the field in quality, delivery, price! Get your copy of "Airmatic Cylinders for Automation", Bulletin 91017, today.

AX-24

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INC.  
7313 Associate Ave., Cleveland 9, Ohio

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## Fractional Horsepower Motors



### Lamb Thinking on Universal Motors for a unique actuator application

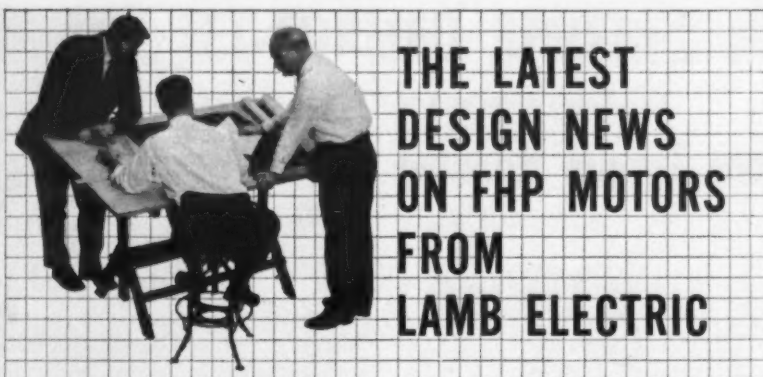
Here's what Lamb Electric designed into these motors:

In order to obtain the required speed and torques and retain the most economical and smallest package, a combination worm and spur gear reduction was used. Also, because of the peculiar space limitations in the application, special design considerations had to be given to the gear ratios and mechanical layout of the package.

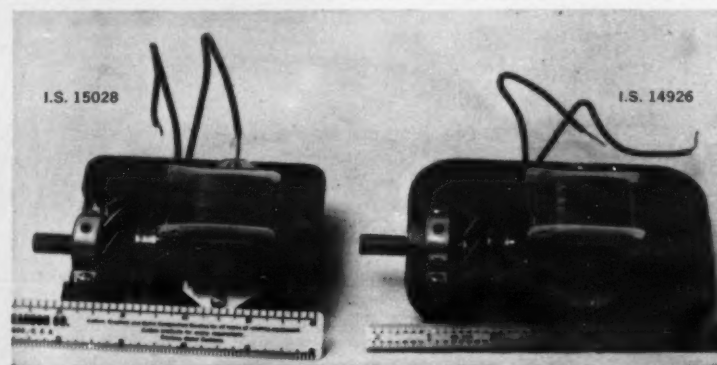
In the initial stages of the design a motor was provided which met the specified speed and torque requirements, however it was soon discovered that this design overheated rapidly. Analysis of the first prototype tests showed that the load cycle had a particularly high torque peak for a very short duration. The motor was designed to supply this amount of torque near its stalled speed. It was found that by taking advantage of the accelerating rate and starting torque of a universal motor, the motor accelerated quickly enough to provide sufficient inertial energy to complete the duty cycle. This enabled the engineers to redesign for a lower peak horsepower output and obtain reasonable operating temperatures, thus producing the minimum size package consistent with the torque and temperature requirements.

The application was such that severe shock loading was encountered at a certain point in the duty cycle. In order to make mechanical construction that would withstand this service, ductile iron castings were furnished and special consideration had to be given to the overhung moment of the motor-gear unit to insure against damage due to vibration. Special bearings had to be used in this service because Brinelling would occur on normal ball bearings under the severe service encountered. Lubrication is generally a problem under this short duty cycle, therefore, special consideration had to be given to insure that the lubricant protected the wearing surfaces at all times.

This is just a short example of Lamb at work... if you have a motor problem, let us help you with it. This is our business. Write: Lamb Electric, Kent, Ohio, and we'll have a Lamb District Engineer call on you to open preliminary discussion of your problem.



## THE LATEST DESIGN NEWS ON FHP MOTORS FROM LAMB ELECTRIC



### New Lamb motors represent advancements in small universal motor design

New design combines high quality and long life with relatively low manufacturing costs

Initially, the I.S. 15028 and companion motor I.S. 14926 were designed for powering rug agitators on a well-known line of canister-type vacuum cleaners. Now, many future appliance applications have been visualized. The range of ratings possible with this design (as high as 1/10 H.P. at 12000 RPM or 1/8 H.P. at 15000 RPM) makes this motor ideally suited for many motor powered domestic applications.

Some of the novel features of this motor project were:

The housing is a one-piece simple phenolic molding. It is designed in a half shell form in such a way that the motor bearings and other components can be held in accurate relationship with an unmachined housing.

The half shell housing of the motor is designed to mate with a corresponding opening on the customer's device to complete the motor enclosure. When a free standing motor is desired, this

upper enclosure can be a simple stamping.

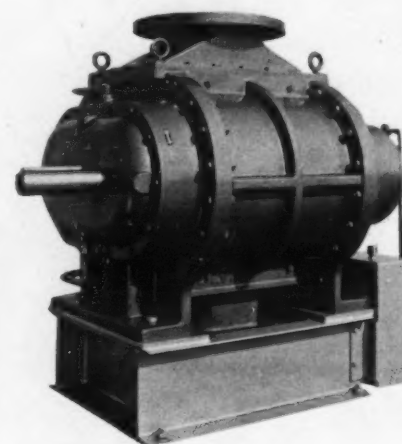
The I.S. 15028 motor was designed with a sleeve and a ball bearing. However, on other versions of this motor, either sleeve or ball bearings or a combination can be used at only a low tooling expense through use of easily interchanged inserts in the housing mold cavity.

The sleeve bearing as used in this design takes full advantage of the economics possible with the half shell motor design. The full-spherical shaped self-aligning type of sintered bearing is mounted directly in a semi-spherical recess in the housing. A spring clip presses against the top of the bearing to secure it in place while at the same time permitting self-alignment movement. Life-time lubrication is provided by an oil soaked felt strip located beneath the bearing. There are other features worth noting in this unique design problem. For further particulars, write to Lamb Electric Co., Kent, Ohio.

## IDEAS...MECHANICAL

### Cap-Screw Head Friction

Edward W. Schrader, Western Editor



When sufficient torque is applied to place cap screws in tension, friction between heads and mating surfaces drives the impellers in a heavy-duty industrial blower. The one-piece, forged-steel shaft slip-fits through the impeller. The pieces are bolted together at the gear end.

This design approach removes the stress concentration of an interference fit between the driving shaft and the impeller bore, allowing both the shaft and the impeller to carry their full torque load without failure.

The one-piece shaft permits the input shaft to support an overhung load caused by a V-belt or other drive system. The input shaft acts as a torsion bar on starting.

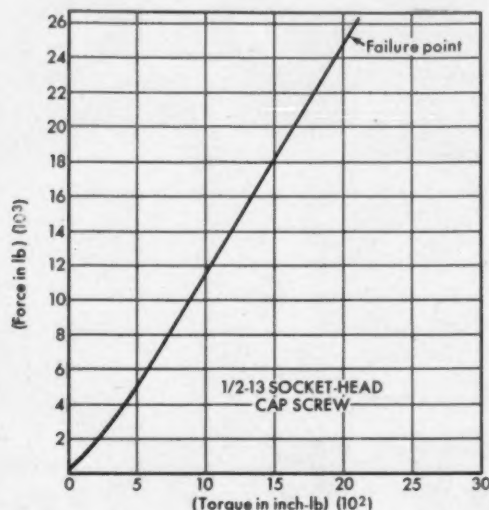
By avoiding the interference fit between the hub of the impeller and the shaft, the loop stresses in the hub are eliminated. This makes it possible to increase the bore size of the hub and hence increase the shaft diameter within the hub. A larger torque load may therefore be carried by the entire assembly.

The stub end of the shaft carrying the driving gears between the two impellers may likewise be increased and this reduces the torsional deflection of the shaft between the timing gear and the impeller. Pressure and horsepower ratings of the blower may then be increased.

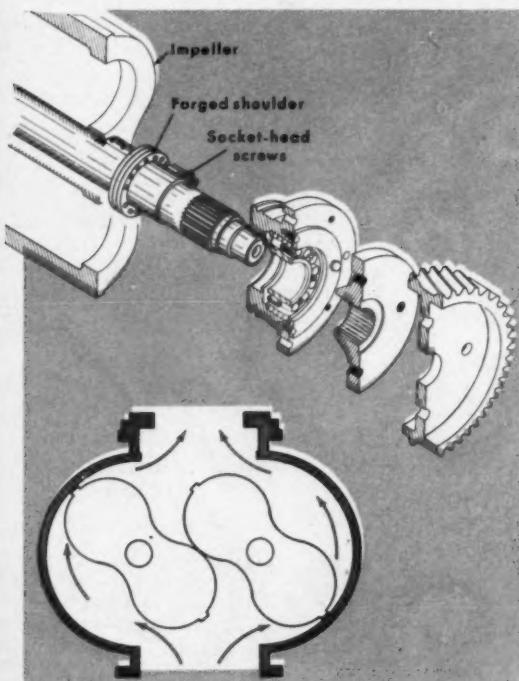
The rotary positive blowers, Series 3200, incorporating this shaft arrangement, are a design development of Sutorbilt Corp., Compton, Calif. They are designed to handle 800 to 23,000 cfm of air at 2 to 12 psig continuously.

Circle 21 on Reader-Service Card for more information

## Transmits Blower Torque



GRAPH shows force in pounds under head of 1/2-13 socket-head cap screw versus torque applied in tightening.



CAP SCREWS through forged shoulder on shaft pull impeller tightly against shoulder. Friction between cap-screw heads and shoulder, and between shoulder and impeller, transmits driving torque from shafts to impeller. Same principle is used to bolt helical gear to drive plate.

## New from Du Pont—

# FABRICS COATED WITH VITON®

**A synthetic compound that resists abrasion, corrosion, oils, solvents, temperature extremes**

There are new opportunities for coated fabrics when durable "Viton"® synthetic rubber is combined with fabrics of glass, "Armolon"® TFE-fluorocarbon resin-coated glass, "Dacron"® polyester fiber, or "Teflon"® TFE-fluorocarbon fiber.

For example, a glass fabric coated with "Viton" and laminated to Refrasil fabric ("Fairprene"® 85-002) for use as a missile screen, when exposed for 60 seconds to 5700°F., 1½ inches from the surface, shows only slight charring of the Refrasil and practically no effect on the "Viton" coated glass which forms the alternate side of the laminate. "Viton" maintains its elastomeric properties despite this heat...can also withstand temperatures as low as minus 40°F., in gauges up to .020", without cracking.

An "Armolon" fabric coated on one side with "Viton" has proved promising as a tubing for transporting corrosive gases. These tubes can be heat-sealed on the "Armolon" side, with "Viton" on the outside, assuring excellent resistance to heat and chemicals as well as low permeation loss of the gases.

Fabrics coated with "Viton" are available for experimentation, test runs, or full-scale production operations. Contact your nearby Du Pont "Fairprene"® representative for complete information, or send coupon at right for literature and information.

\*Du Pont registered trademarks

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### PHYSICAL PROPERTIES OF FABRICS COATED WITH "VITON"

	86-007	85-001	84-001
<b>Description:</b> Polymer Fabric	"Viton" A "Teflon"	"Viton" A #116 Glass	"Viton" A "Dacron"
<b>Properties:</b> Gauge	.020"	.011	.008"
Wgt., Oz./Sq. Yd.	22	15	9
Tensile Strength Strip, Lbs./Inch, W x F	77 x 73	117 x 90	81 x 70
Tear Strength Trap., Lbs. W x F	16 x 13	1 x 1	2 x 3
<b>Abrasion Resistance</b> 1 Lb. Edgewear Strokes	10,000	10,000	10,000
<b>Burst Strength, Mullens,</b> PSI	168	172	158
<b>Gehman Stiffness</b> T10* °F.	3°	3°	3°

\*Temperature at which it is 10 times as stiff as at 77° F.

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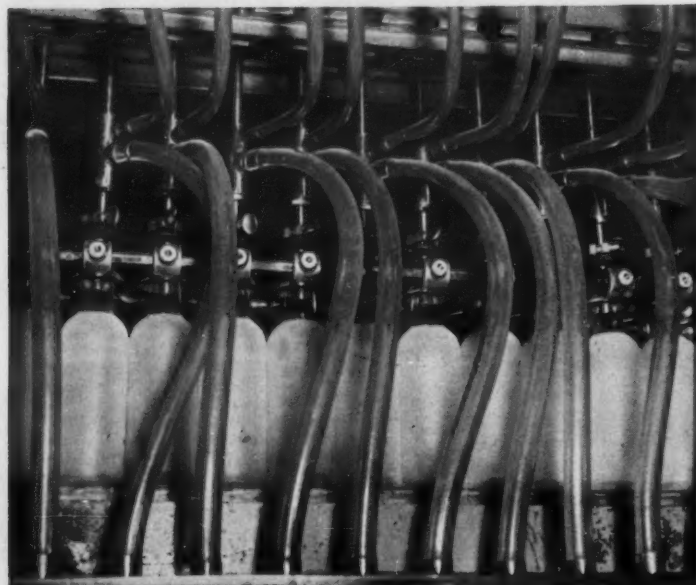
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441F-1



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## IDEAS...MECHANICAL

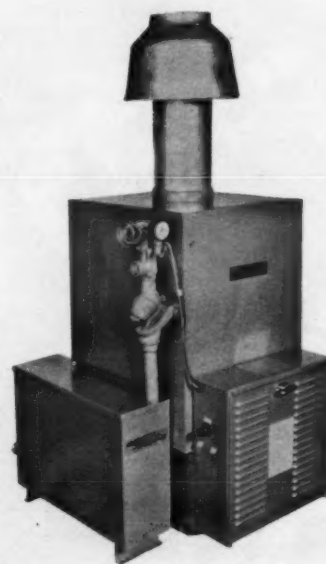
### Hot Combustion Gases

Edward W. Schrader, Western Editor

In a swimming pool water heater, the hot combustion gases enter a spray chamber where they mix directly with spray droplets. Stainless-steel burners located in the base of the assembly burn 100 percent of the raw gas-air mixture. The rising gases enter the spray chamber laterally above the water line. As the hot gases engage the spray droplets, the heat is transferred directly to the water.

The exit-flue gas is in the temperature range of 100 to 105F. Since this temperature is too low for good flue gas draft, a propeller forces the cool gases up the flue. Water entering the center spray nozzle revolves a turbine which turns the propeller. The more water pumped from the filter pump into the spray nozzle, the faster the propeller turns, thus inducing a draft to flue gases.

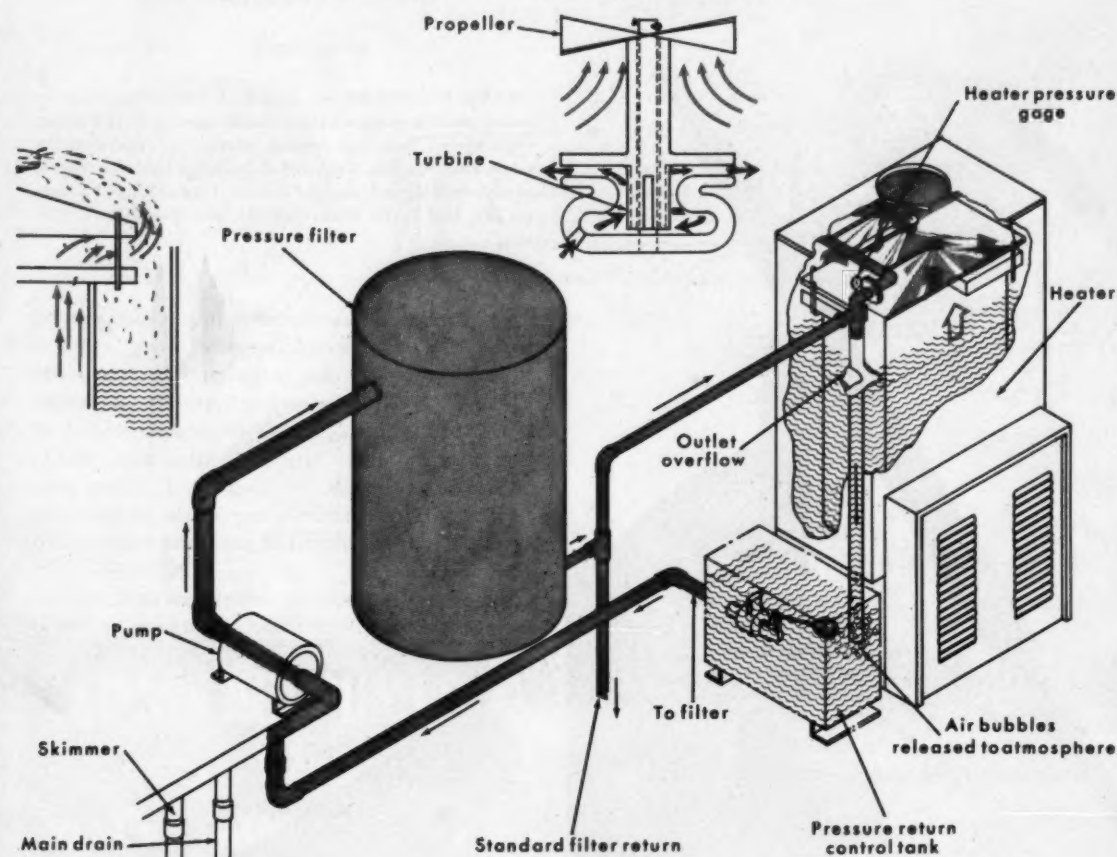
Water surrounding the copper combustion chamber absorbs radiant heat. Combustion gases running well below their dew point condense into water at the rate of about 2.3 gph and aid, rather than lower, the efficiency of the unit by 19,182 Btu/hr. Heat transfer is accomplished with an efficiency of 96 percent.



POOL HEATER may be added to existing pool installation. Unit must be installed at deck level or higher, because gravity drain is used when filter is dirty.

DESIGN NEWS—MAY 8, 1961

## Transfer Heat Directly to Spray Droplets



HOT COMBUSTION GASES enter chamber and pass through water spray. Float-operated valve in tank adjacent to heater serves as pressure return control. Water leg is main-

tained in heater by overflow vent to pressure return tank. Water turbine and fan in center spray head forcefully expel flue gases.

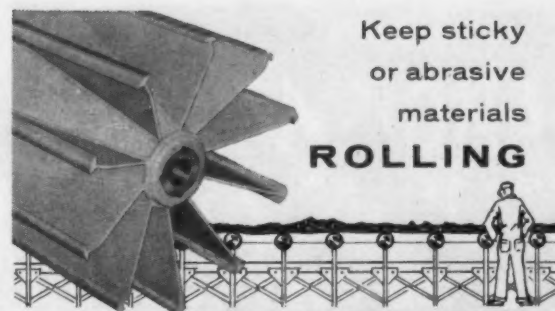
Water enters the heater from a pressure filter. A spring-loaded bypass valve at the inlet begins to operate at 8.5 psig. Excess bypass water moves through a jet pump to a pressure-return control. The jet pump serves to draw water from the top of the water leg in the heater to the exterior pressure-return control. Below 8.5 psig, all the water passes through the spray nozzles and drains from the water leg by gravity to the pressure-return control. On the inlet casting, a 0- to 15-psi pressure gage, a 4-psi on-off pressure switch and a pool thermostat control the heating unit.

The pressure-return control consists of a tank with a float-operated check valve. In this tank, excess air bubbles are released to atmosphere. The out-

let of the tank operates on the suction side of the filter pump. Thus, the heated water is returned through the filter and back to the pool. The float-operated check valve maintains a suction seal for the pump.

Products of combustion are water and carbon dioxide, since 100 percent combustion is achieved in the burner. The carbon dioxide and the water combine to form carbonic acid (carbonated water). This is a weak, unstable acid which maintains the acid content of the pool at 7.4 pH without any addition of muriatic acid.

The Spray-Ray pool heater is a design development of Raypak Co., Inc., El Monte, Calif.



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or abrasive  
materials  
**ROLLING**

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## Turn-Clean® PULLEYS

Van Gorp Turn-Clean pulleys are of all-welded steel construction, with gussets continuously welded to wings and hub to insure maximum ruggedness and top self-cleaning performance under severe working conditions. Dodge Taper Lock bushings permit simple, sure installation. In addition, only Van Gorp offers a selection of 3,000 pulley sizes with four face selections, and custom manufacture to exact specifications. All popular pulley sizes are stocked for prompt shipment. Write for new brochure on 7 ways to cut costs with Van Gorp Turn-Clean pulleys and a free sample of the new "Rubber Lagged" Turn-Clean pulley — the answer to tough drive pulley problems.

**VAN GORP MFG., INC.**  
Dept. DN, Pella Iowa

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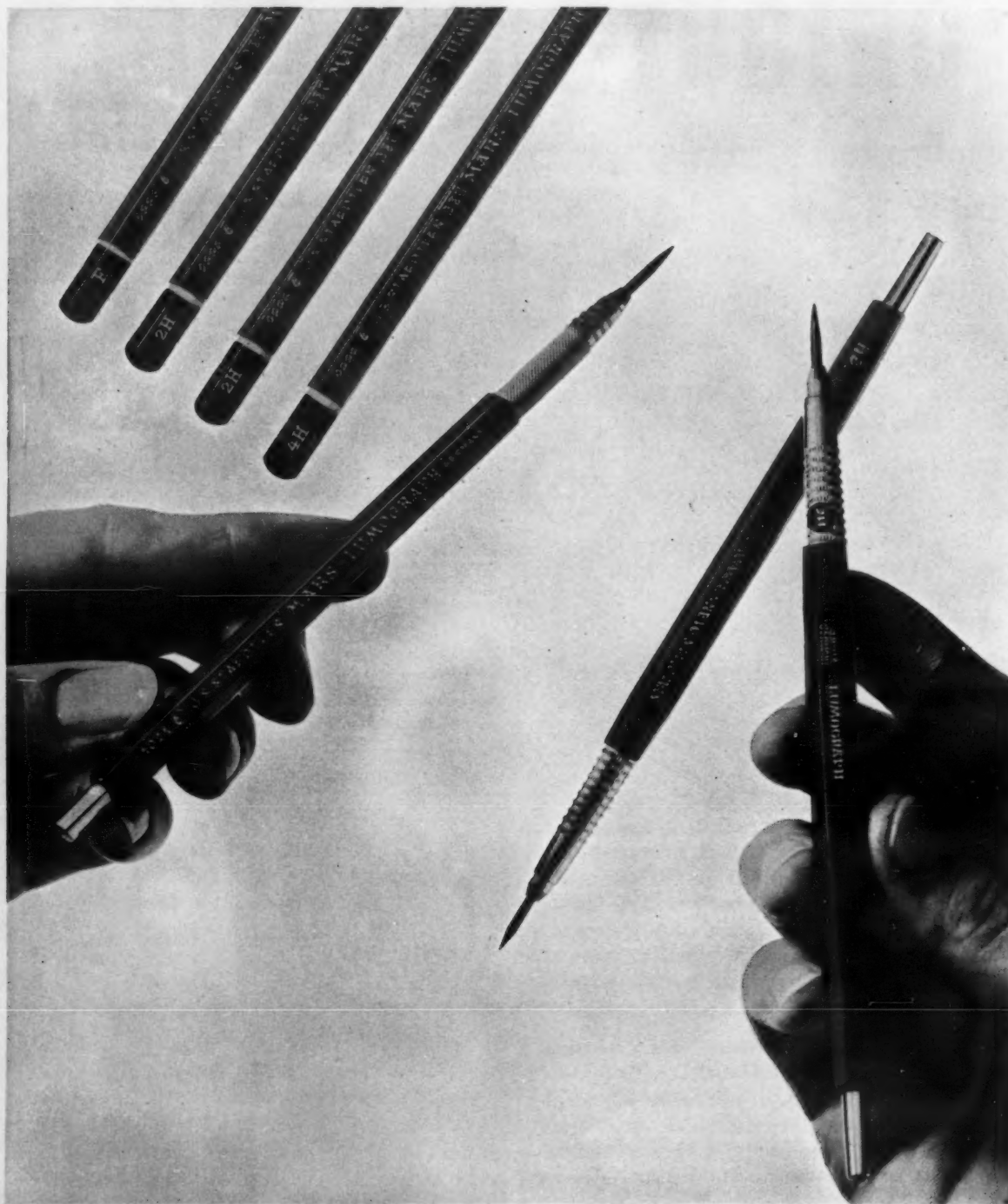


Solve difficult linear motion problems, including stick-slip, with Tychoway bearings. They equalize starting and moving friction (coefficient of less than .005). Rigidly support heavy machine components on precision, recirculating rollers. Permit moving 5000-lb loads smoothly at low speeds with only 25 lb of force. Eliminate complex assembly operations and adjustments. Can be preloaded or mounted in any position. Write for Bulletin 22-50.

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**MARS vs MARS** — You need neither lawyer nor judge. Let your own preference decide in favor of one

MARS over another. For whether you pick one of the wood-cased Lumographs or one of the Technicos you'll be using the very finest.

Among the famous imported Mars drafting products are: the Mars-Technico push-button lead holders (with adjustable degree indicator\*, with specific degree imprint\*, the economy model\*); Mars-Lumograph drawing leads, 18 degrees, EXB to 9H; Mars-Lumograph drawing pencils\*, 19 degrees, EXEXB to 9H; Mars-Duralar pencils and leads for drafting on Mylar®-base drafting film — 5 special degrees, K1 to K5; Mars-Duralar Technicos with adjustable Duralar degree indicator; Mars-Lumochrom colored drawing pencils, 24 shades. Also: Mars Pocket-Technico for field use; Mars pencil and lead sharpeners; Mars Non-Print pencils and leads; Mars-Duralar erasers. Mars products are available at better engineering and drafting material suppliers everywhere.

© T.M. for duPONT's Polyester film. \*Shown.

*the pencil that's as good as it looks* **MARS**  
J.S. STAEDTLER, INC.  
HACKENSACK, NEW JERSEY

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## IDEAS...MECHANICAL

### Crank Plungers

Celestino O. Lubatti, Italian Editor

CRANK PLUNGERS are placed at 120-deg intervals to insure positive grasp on three points of work face. Plunger replacement does not require removal of work carrier from drive spindle. Rounded shoulder behind flat spring permits pulling out plunger axially. Various tipped plungers are used to fit work diameter and direction of rotation.

Gripping plungers formed into chisel-shaped crank tips adapt to an irregular work face and hold with pressure that is constantly proportional to drive torque. Drive torque applied to the work-piece through this live center causes rotation of the plungers about their individual axes; this is caused by reaction of V-grooved inner ends against thrust balls. Grasping is thus positive and completely independent of axial force applied to the center spindle.

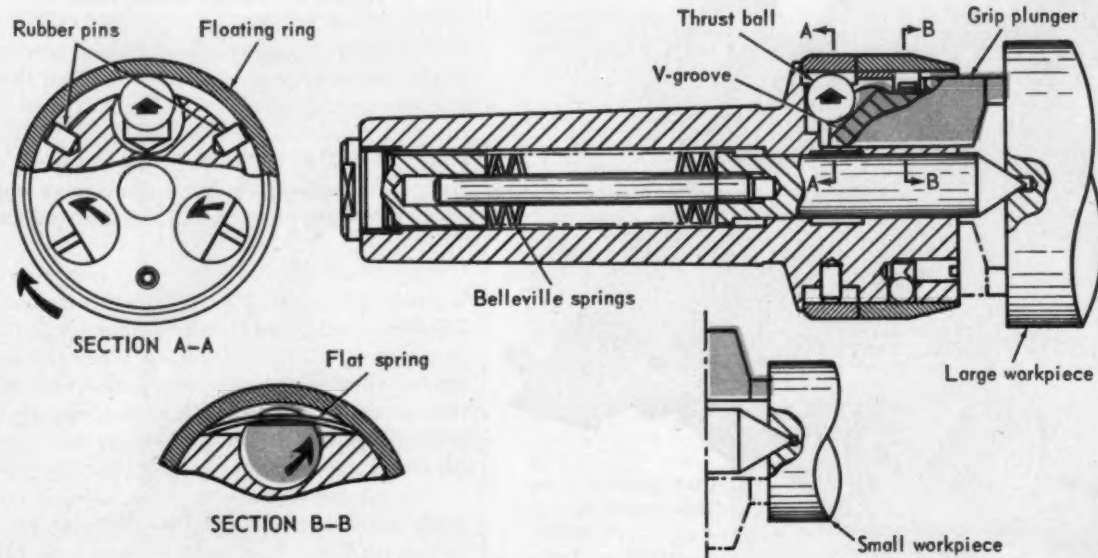
Flat springs entering transverse slots on the plungers turn plungers back as driving power is



released. A floating ring around the three thrust balls allows for differential swing amplitude of the grip plungers in order to match the irregular (or uneven) work face. Rubber pins on the carrier body limit oscillation of the floating ring. The center spindle is forced against the work by adjustable "Belleville" springs arranged inside the hollow shank.

The work carrier was developed by G. Ulrich of U.T.I.T.A. SpA, Este, Padoa, Italy.

## Convert Torque into Axial Thrust for Positive Grasp

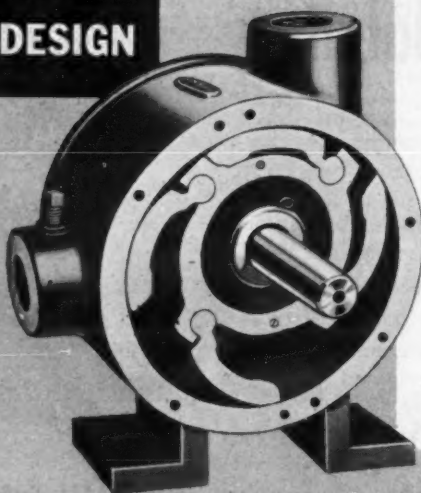


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**HINGED VANE DESIGN**

• The simplified Leiman hinged vane design provides larger air space, higher capacity—permits use of smaller pumps, slower speeds, lower horsepower. Every pump rigidly test-run before shipment. Specify Leiman Air Pumps for your vacuum, suction or pressure operations for lifetime dependability. Consult Leiman engineers on any application.

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**Self-honing surfaces.** Curved cast iron vanes rotating against cast iron cylinder walls hone wear surfaces to a hard, glassy smoothness. Provides continuous leak-proof seal and low-friction operation.

**Self-renewing vanes.** Cast iron vanes take up their own negligible wear. No composition tips to wear and renew. Provides years of new-pump efficiency.

**Self-oiling.** Leiman Automatic Oiler feeds the right amount of oil while running—needs no manual regulation—prevents over-oiling—reduces possibility of oil-staining.



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**LEIMAN** Rotary Positive  
**AIR PUMPS**

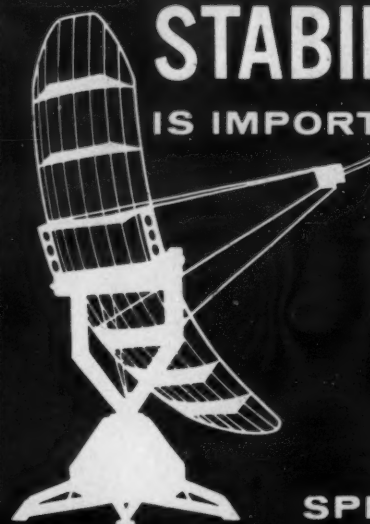
Vacuum to 29.9" Hg. Pressure to 20 p.s.i.g. Volume to 162 c.f.m.

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## PRECEDENT 71

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DIMENSIONALLY STABLE TO 0.00001" PER INCH

Parts in computing devices, aircraft or missile guidance systems, and electronic equipment must be dimensionally stable, sometimes to a few millionths of an inch per inch. Two factors interfere with such dimensional stability: (1) locked-up stresses and (2) growth. While there are many approaches to the solution of this problem, most involve a lot of time and trouble, but contribute little to stability of parts.

The most positive solution is the use of Precedent 71 aluminum casting alloys which may be stress relieved by heat treatment at 700°F for four hours followed by cooling in still air. This stress relieving heat treatment is applied to the raw casting and no subsequent treatment is required. After stress relieving at 700°F, Precedent 71 A and B alloys are completely dimensionally stable to 0.00001" per inch.

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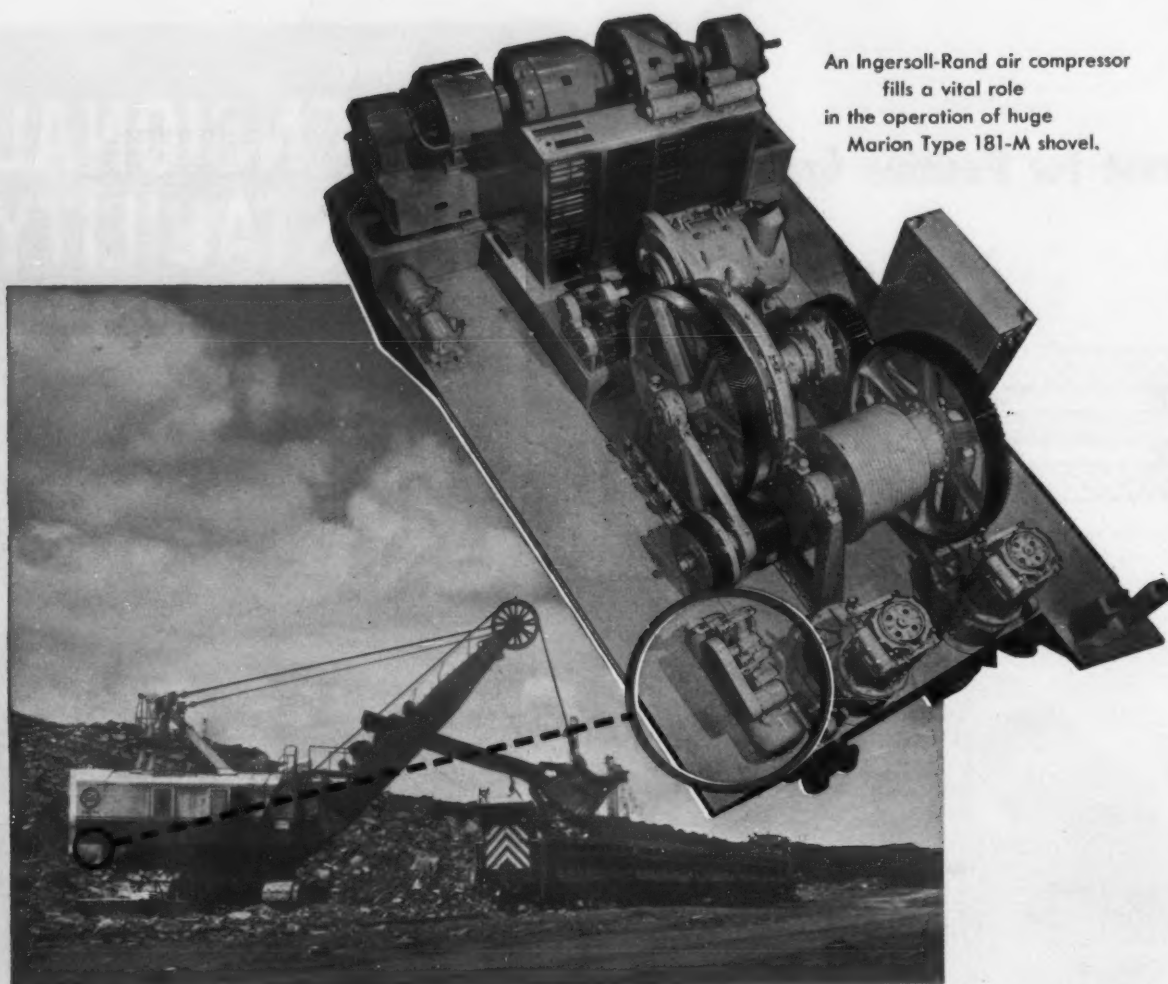
## WILLIAM F. JOBBINS INCORPORATED



P. O. BOX 230A  
AURORA, ILLINOIS

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An Ingersoll-Rand air compressor fills a vital role in the operation of huge Marion Type 181-M shovel.

## IDEAS...MECHANICAL

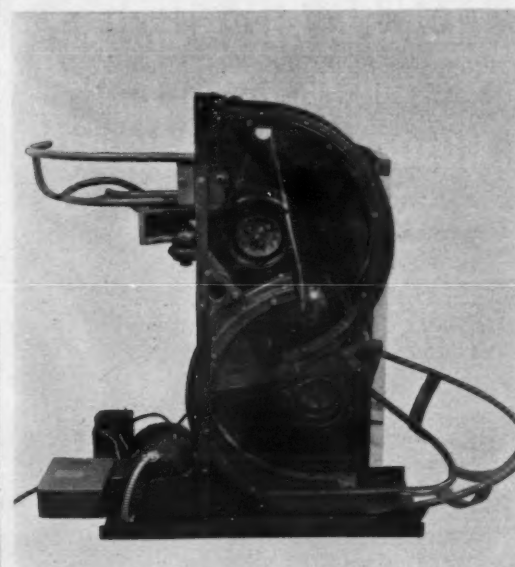
### One-Way Clutch Drive

Robert L. Candlish, Detroit Editor

Incorporation of a sprag-type one-way clutch drive in the first stage of a subway bowling-ball lifting machine permits the bowling ball to enter the lift at a brisk rolling speed without damaging either the ball or the lift. Bowling-ball speed and energy are dissipated by rotating a contact wheel, which over-runs on the one-way clutch mounted on its shaft.

This avoids the shocking impact of having the bowling ball contact a solidly connected mechanical-drive mechanism; also, it eliminates marking or scrubbing of the ball surface. When the bowling ball slows to the speed of the lift wheel drive, the one-way clutch instantaneously re-engages and transmits power to lift the bowling ball up the lift chute.

The automatic power ball lift, using a Form-sprag overrunning clutch, is produced by the Brunswick Corp., Bowling Div., Muskegon, Mich.



TWO METAL RUBBER-FACED WHEELS are driving members propelling balls up through two connected semi-circular chutes. Drive wheels are driven at approximately 140 rpm by flat belt and pulleys by fhp motor. Lower wheel is connected to driveshaft by sprag-type one-way drive clutch. Clutch inner race is keyed to shaft. Outer race is pressed in drive-wheel hub. Clutch overruns to absorb speed difference between rolling ball and drive wheel.

## design with Ingersoll-Rand for dependability

Get complete details from your Ingersoll-Rand representative or write for catalog data.



147A3

Equipment designers and product engineers can match their most rigid specifications from this *complete* line of Ingersoll-Rand air-cooled air compressors. Top efficiency and operational economy plus important savings in space and weight make I-R compressors the top choice for dependable components.

Ingersoll-Rand air-cooled air compressors are available as bare units, baseplate mounted or tank mounted in sizes 1/2 through 20 hp. In addition, I-R can furnish high pressure compressors, non-lubricated compressors and vacuum pumps.

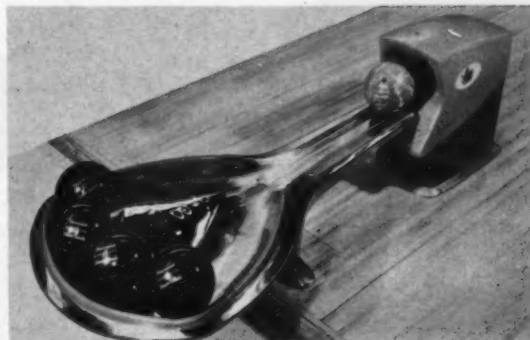
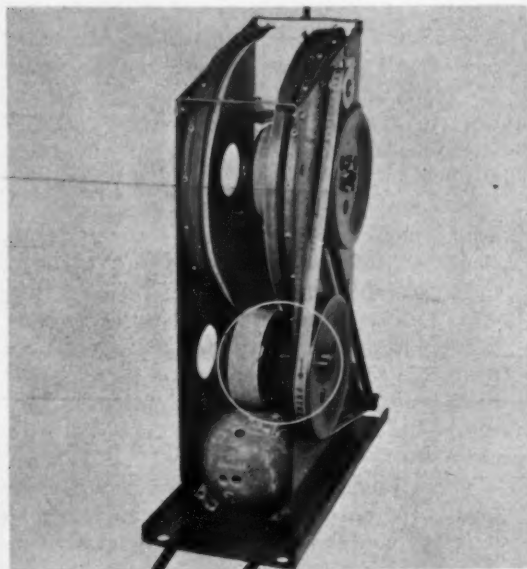
## Ingersoll-Rand

11 Broadway, New York 4, N.Y.

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DESIGN NEWS—MAY 8, 1961

## in Lift Provides Gravity Stop of Rolling Ball

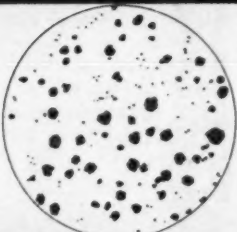


**BALL LIFT** delivers ball to storage rack at conventional rack height.

**BALL POWER LIFT** elevates ball from under-lane return up onto storage rack. Under-lane return eliminates need for surface return rack alongside lane, reducing floor area requirement per lane and bowler distraction.



Gray Iron



Ductile Iron

## WELLS DUCTILE IRON CASTINGS

*have the processing advantages of IRON*

*... the mechanical properties of STEEL!*

As shown in the photomicrographs at the left, graphite in ductile iron has a *spheroidal* shape, which eliminates the weakening, embrittling effects caused by the graphite *flakes* in ordinary gray iron. It is a far stronger, tougher, and more ductile material, yet retains the processing advantages of cast iron: low melting point, good castability, and good machinability.

No other cast metal provides such a unique combination of useful engineering

properties.

Wells produces ductile iron castings up to approximately 60 pounds . . . by shell molding, CO<sub>2</sub>, and regular sand molding processes. Ten basic types of ductile iron including the Ni-Resist type, encompassing a broad range of mechanical and chemical properties, are offered. Tensile strengths range from 60,000 psi to more than 150,000 psi with elongations up to 30%.

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### Typical Ductile Iron and Ni-Resist Ductile Iron Castings Produced by Wells



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DESIGN NEWS—MAY 8, 1961

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2	Chrome Alloy Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Steel Ball	For types operating under normal loads with minimum friction requirements.
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There's a *difference*, as you can see! The 10-groove D-section sheave in the foreground is replaced with the narrow 8-groove 5-V Dyna-V sheave on the line shaft. *Same power*, in a far more compact installation, with a \$477 difference in price. And big future savings in belt replacement costs!

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Dyna-V can handle 3 times as much power in the same space. Dyna-V Sheaves decrease shaft overhang, increase bearing life. And Dyna-V Belts possess *all* premium qualities. Conditions requiring static conductivity or resistance to oil, moisture and heat are met by Dyna-V's one grade—the finest. Ask your Dodge Distributor, or write us for complete drive bulletin. Dyna-V Drives are available for capacities from 1 to 1500 hp.

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**CALL THE TRANSMISSIONEER**, your local Dodge Distributor. Factory trained by Dodge he can give you valuable assistance on new cost-saving methods.

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## IDEAS... MECHANICAL

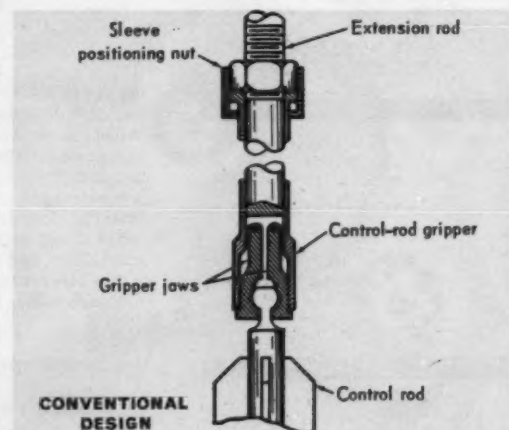
### Control-Rod Gripper Design

Lars G. Soderholm, Midwest Editor

A new control-rod gripper design uses the spring tension of a split, tapered metal tube to engage and retain a tip which forms the end of the control rod. The control rod can be released by passing an expander bar through the tapered interior of the gripper to spread the split halves.

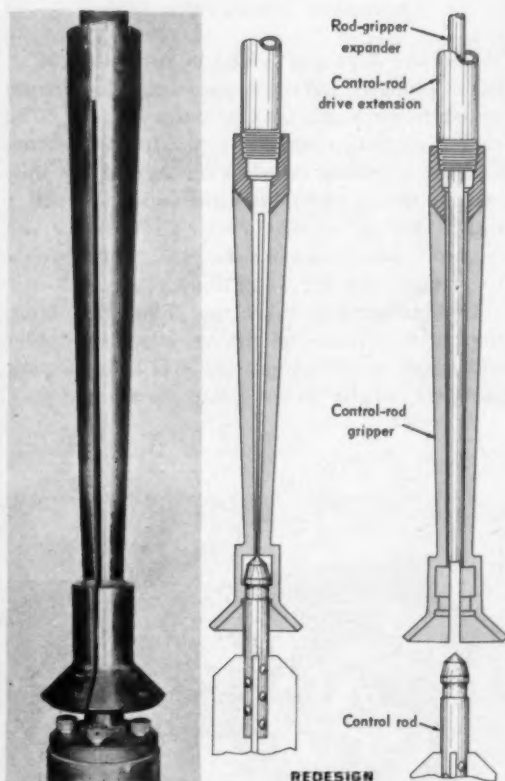
A control-rod gripper is used in a nuclear reactor to hold the control rods so they may be disconnected from the mechanism that regulates their position in the core. During fuel handling operations or whenever the reactor vessel cover is removed, it is necessary that the control rods themselves remain in the core, yet the extension shafts must be removed. The grippers must then engage the rod tips easily when the system is re-assembled.

The advantages of the new design are: fewer total parts, no moving parts, operation not affected by corrosion and a fast clamping and releasing action. The new control-rod gripper is machined from a single piece of steel. The funnel-shaped opening permits the control-rod tip to be guided through the split jaws which snap firmly into the groove under the tip.



**CONVENTIONAL DESIGN** control-rod gripper may use two pivoted gripper jaws on extension rod. When gripper jaws are in place over ball-shaped projection from control rod, sleeve is brought down over both jaws to prevent them from separating. Sleeve is advanced by turning sleeve-positioning nut over threaded portion of extension rod. This is done manually through special wrench and extension. To release control rod, sleeve must be backed off in similar manner. Corrosion may make it difficult to retract positioning nut.

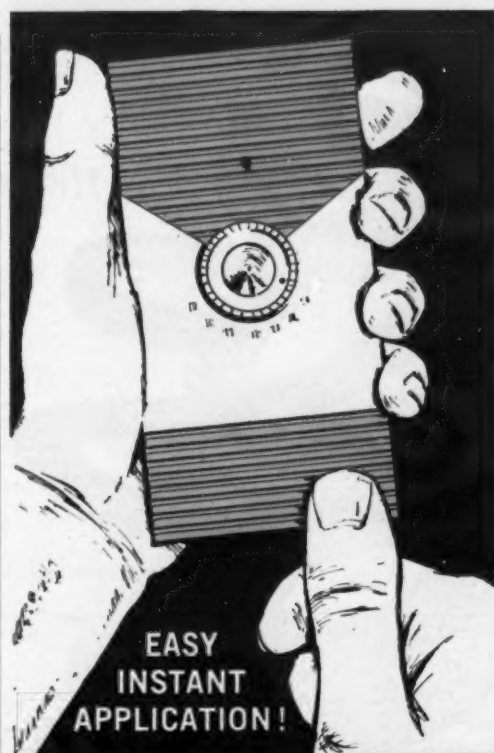
## Has No Moving Parts



**NEW GRIPPER DESIGN** consists of split machined member with bell-shaped tip guide, clamping jaws and tapered hollow interior. Top is threaded to accept extension pipe. When control-rod gripper is lowered over control-rod tip, bell-shaped opening guides tip between gripper jaws. Downward force on control-rod gripper causes jaws to separate and snap shut over machined groove in control-rod tip. Spring tension in gripper holds control rod in place. To release control rod, solid gripper-expander rod is inserted through extension pipe into tapered interior of split gripper and pressed down, forcing control-rod gripper jaws to separate.

A prototype model of the gripper was built and tested under simulated reactor operating conditions. The gripper supported a load of 85 lb in a magnetic jack-type control-rod drive test rig for approximately one year in water at 300 psig and 421F, with weekly cooling-off cycles. The disengagement performance of the gripper never differed from pretest behavior.

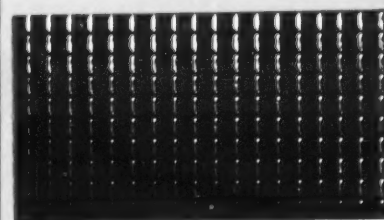
The control rod gripper was designed by E. E. Hamer, fabricated and tested by J. N. Young of the Argonne National Laboratory, Argonne, Ill.



# 26

## EMBOSSED DESIGNS IN 6 METALLIC COLORS...

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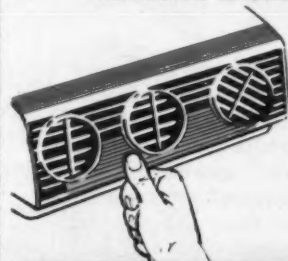
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MADE WITH **MYLAR**

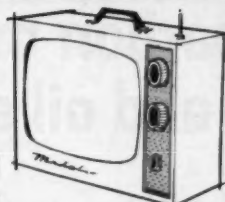
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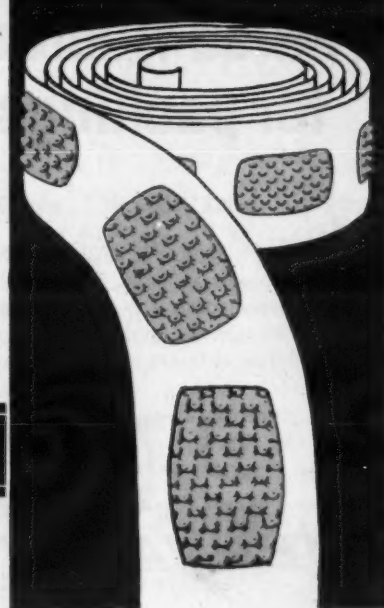
NEW YORK: Wisconsin 7-4435

\*A DuPont Polyester film

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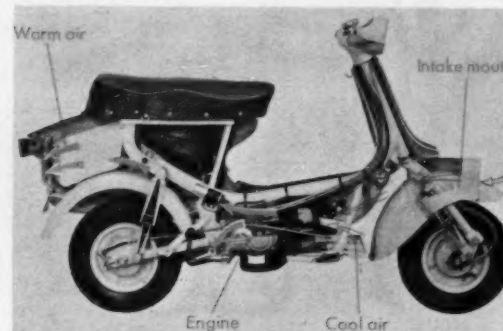
## IDEAS...MECHANICAL

### Plungers Replace Balls,

Celestino O. Lubatti, Italian Editor

Rounded-V tops and saddlelike bases on gear selector plungers reduce stresses and wear in the gearshift mechanism of a motor scooter. The curved surfaces respectively match gear notches and the actuating shoulder on the selector shift rod, imparting radial pressure on a line contact rather than on a point. Better performance and design compactness make the plungers preferable to previous clutch balls or sliding keys.

Constant-mesh gears are on a hollow shaft housing the shift rod. The tapered selector shoulder slides against and under saddlelike bases to push plungers radially outward into the selected gear.

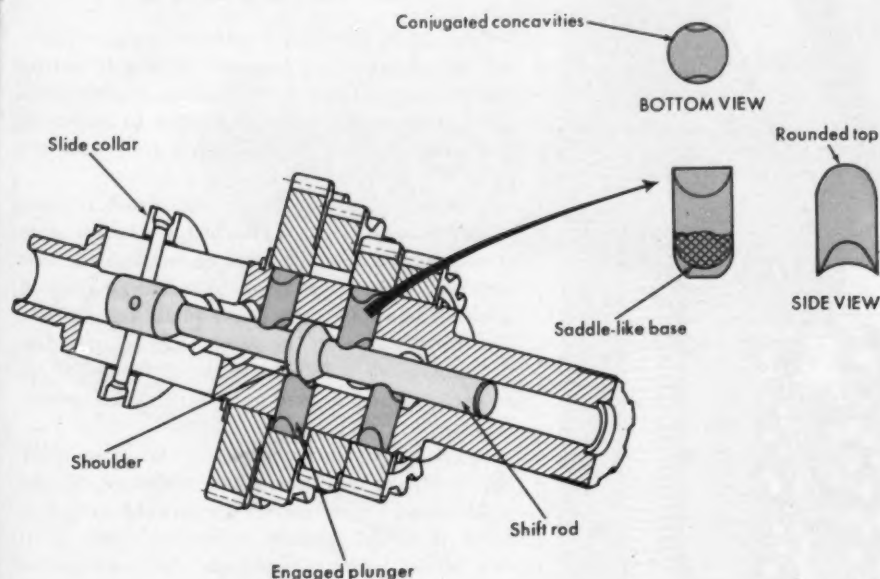


SCOOTER BODY wraps 77.8-cc, 3.7-hp, two-stroke engine, forms longitudinal tunnel for natural circulation of cooling air. Elimination of fan saves more than 10 percent of engine power, allowing 50 km per liter (141 mpg) fuel economy. Air current enters mouth on front fender, flows through central tunnel with larger cross-sectional area to draw additional cool air from sides. Back and bottom apertures allow escape of warm air.

Conjugated concave surfaces forming the saddlelike base are shaped to permit line contact with both the conical and the cylindrical parts of the shoulder. The semicylindrical top of each plunger has line contact with inside rim, as well as with either of two diametrically opposed notches of the gear.

A compact gearbox and elimination of cooling fan reduce weight and production costs. Satisfactory cooling is obtained by natural air flow through a tunnel housing the engine. The "Scooter 80" model is a recent development of Edoardo Bianchi SpA, Milan, Italy.

## Reduce Specific Loads in Gearshift



**SLIDING COLLAR** is keyed to shift rod and rotates with driven shaft. Radial plungers engage constant-mesh gears; these form compact row for minimum shaft length. Perpendicular concavities provide saddle-like plunger-base to match tapered shoulders. Drawing has four gears, only illustrates principle.

Pick up **DAMASCUS**



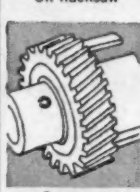
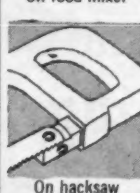
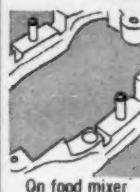
Write for descriptive literature and name of your distributor.

**RICHARD BEST** PENCIL COMPANY, Inc.  
DN-1 Springfield, N. J.

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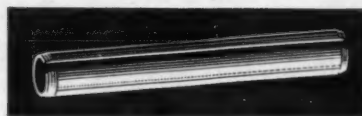
DESIGN NEWS—MAY 8, 1961

## Use it for positioning... SEL-LOK spring pin



- Swift fastening—just drill and drive
- Secure locking—won't work loose despite shock or vibration
- Eliminates costly tapping, reaming, peening, milling
- Can be reused repeatedly
- 101 uses—as keys, cotter pins, axles, hinge pins, wrist pins, stop pins, pivots, etc.

SEL-LOK spring pins are available in carbon and corrosion-resistant steel (from  $\frac{1}{16} \times \frac{3}{16}$  through  $\frac{1}{2} \times 4$  in.) and beryllium copper ( $\frac{1}{16} \times \frac{3}{16}$  through  $\frac{1}{4} \times 3\frac{1}{2}$  in.). See your SPS distributor or write for Bulletin 2670.



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## Send for your ROTO-PAK BOOKLET



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- Up to 90% efficient
- Sizes from 11" x 20" to 13" x 55"
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Flexible Tubing helps carry cotton a-mile-a-minute through new Allis-Chalmers Picker ...

## Proof that today's designers can make Flexible Tubing do almost anything

In the newest Allis-Chalmers Cotton Picker, a jet air stream catches the cotton, and blows it — a-mile-a-minute — up conveyor ducts to the basket. Carrying this high-speed air stream from fan to picking units: Flexible Tubing's nonmetallic "Flexflyte."

Allis-Chalmers designers chose "Flexflyte" for two reasons: (1) it provides a fast, easy way to connect the fan outlet to the picking unit — a way that permits the unit to be raised and lowered on the job; (2) it makes extremely tight bends without collapsing.

If you work on any kind of original equipment where the handling of air, gases, liquids, or light solids is a

design problem, there's a Flexible Tubing product just right for the job. Flexible Tubing is at work today in space age products, vacuum cleaners, diesel engines, tape recorders ... literally hundreds of places. Call your nearest Flexible Tubing regional office today.

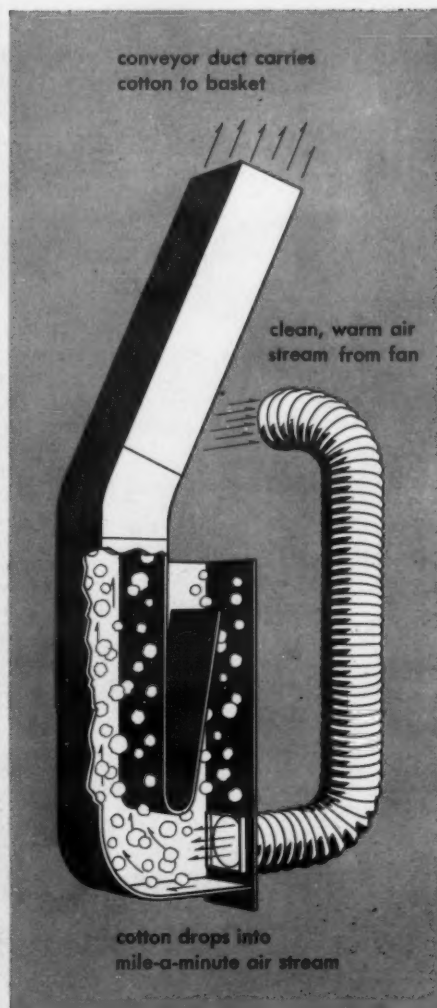


**Flexible Tubing**  
CORPORATION

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## IDEAS...MECHANICAL

### Progressively Stretched

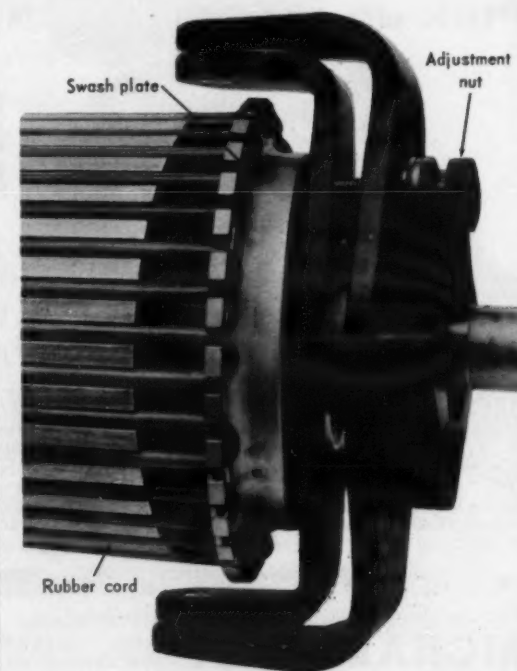
Ronald W. E. Martin, British Editor

Rubber cords stretched lengthwise along a cylinder are progressively changed in length during each cylinder rotation. Movement of the cords exerts a transverse stretching force to paper or thin plastic film as it passes over roller, removing any creases or crinkles.

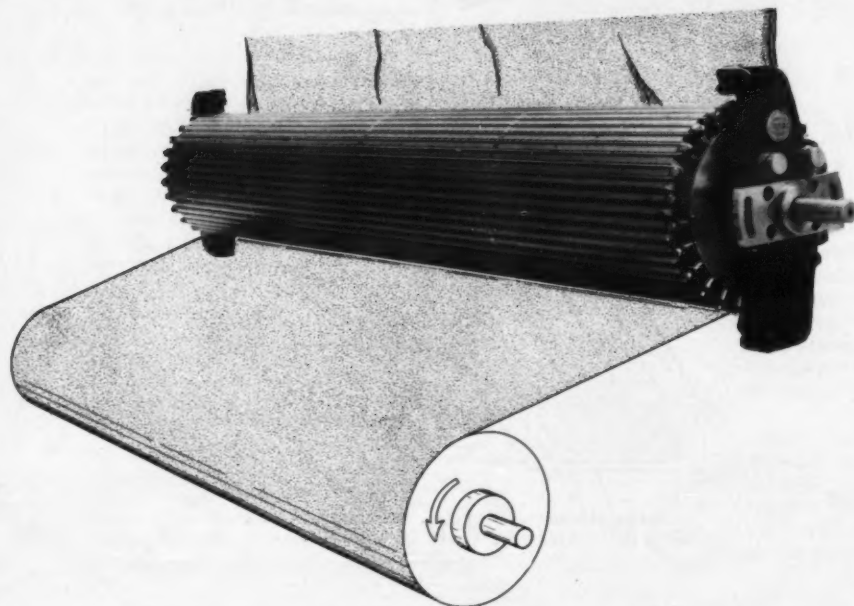
The roller surface is slotted. Rubber cords placed in these slots are attached to a swash plate at each end. The angle between swash plate axes and axis of the roller is set by means of knurled screws. These pivot the swash plates on gimbals. Fixed inclination of the swash plates causes elastic cords (over a 180-deg sector of the roller) to be stretched and relaxed once during each revolution of the roller.

In operation, the web contacts the cords while they are being extended. As the roller rotates, the superimposed web receives an outward spreading effect from the steadily extending cords. It is this action which counteracts the tendency of creases forming in the material.

Designed and manufactured by Vacuum Research (Cambridge), Ltd., Cambridge, England, the web-spreading roller performs the de-creasing operation without introducing a bow into the web.



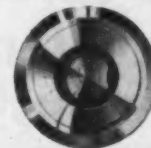
## Rubber Cords Remove Creases during Reel-Up



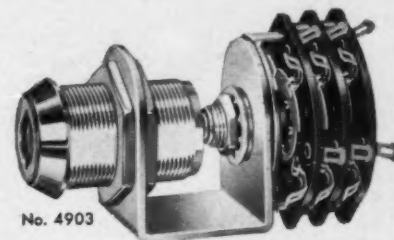
SPREADING ROLLER smoothly exerts transverse stretching force to web passing over it and eliminates creases when winding thin films.

# NEW

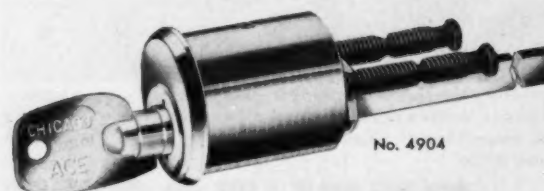
UNDERWRITERS'  
LISTED



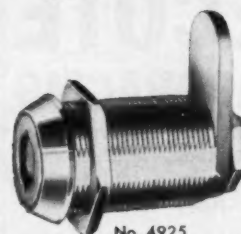
## CHICAGO ACE<sup>®</sup> PIN TUMBLER LOCKS



No. 4903



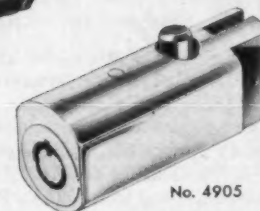
No. 4904



No. 4925



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No. 4905

Here is the only line of locks listed by Underwriters' Laboratories. The unique ACE Locks provide the maximum in mechanical security. Over 80,000 keying combinations are possible so that you may have your own factory-registered tumbler set-up. For technical details on models available for various applications, write for Switch Lock Bulletin UB 501.

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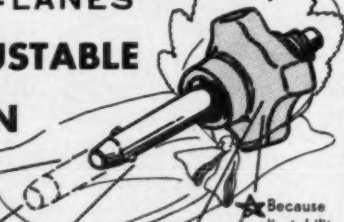
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together

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out - they stay put

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can be salvaged  
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DESIGN NEWS—MAY 8, 1961

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Fractional To 25 HP  
Ratios Up To 8 To 1



**ROTO-CONE**

- 1/8 to 25 HP
- Speed Ratios Up to 4 to 1



**VAR'A-CONE**

- For all 'A' and 'B' belt drives
- 1/8 thru 1 1/2 HP
- Ratios up to 2 3/4 to 1



**ROTO-DRIVE**

- 1/8 to 25 HP
- Speed ratios up to 8 to 1
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**VAR'A-CONE  
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- For 'A' and 'B' belt drives
- 1/8 thru 1 1/2 HP
- Fixed shaft centers



**ELECTRIC REMOTE  
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- Used where drive is out of reach of the operator

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4 page Bulletin—AP-160.



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## Selas saves thousands of maintenance hours on combustion controls



Reevecote synthetic diaphragm goes into place on pressure governor section of Selas Combustion Controller. Reevecote has more than doubled the service life of diaphragms on these units.

## with REEVECOTE SYNTHETIC DIAPHRAGMS

By switching from leather to synthetic diaphragms of Reevecote in its Combustion Controllers, the Selas Corporation of America saved thousands of maintenance hours. They also improved the accuracy of these units.

**Problem:** Originally, leather diaphragms were used in the mixing valve and in the pressure governor of the compressor. These two diaphragms required the most frequent maintenance of all parts in the unit. The leather had a tendency to dry out, stiffen and crack. Accuracy was impaired. The leather required frequent oilings and service life was limited to less than 12 months.

**Solution:** Selas switched to synthetic diaphragms of Reevecote 7134 and 7028, made by the Vulcan Rubber Products Division of Reeves Brothers, Inc. After 2 years of service, diaphragm maintenance has been practically nil. The Reevecote diaphragms retained their flexibility, did not dry out, required no oiling. Accuracy improved and thousands of maintenance hours were saved.

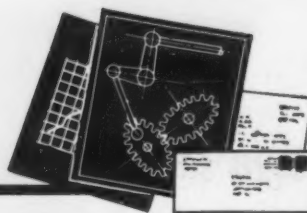
If your design calls for any type of diaphragm — any use of coated fabrics — choose from over 200 styles of Reevecote — the most complete line of synthetic coated fabrics for industry. Write for new Reevecote Catalog.

### REEVES VULCAN

Reeves Brothers, Inc., Vulcan Rubber Products Division  
1071 Avenue of the Americas • New York 18, New York

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## IDEA MART DESIGN NEWS

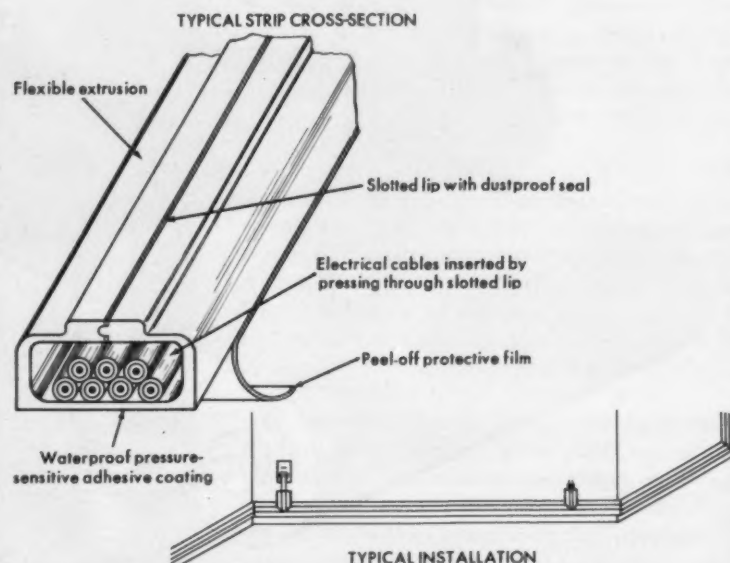


AVAILABLE

### Cable Guide

The purpose of this cable guide is to protect and guide electrical wires, flexible tubes or control cables. Clamps, nails, screws or other fastening devices are not required. The guide is a soft plastic extrusion with a waterproof, pressure-sensitive adhesive coating on the back. The coating is protected by a peel-off cloth layer. A slotted lip with dustproof seal permits insertion of wires or cables.

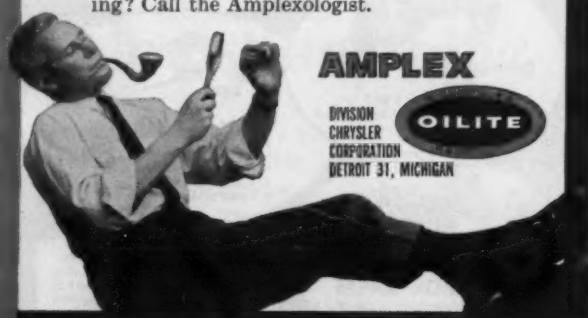
The guide provides a neat installation with accessibility at any point for repair or additions. Miter joints or standard moldings form the necessary fittings along the length. Write IM 504, Idea Mart, Design News, 3375 S. Bannock, Englewood, Colo.



## THE AMPLEXOLOGIST

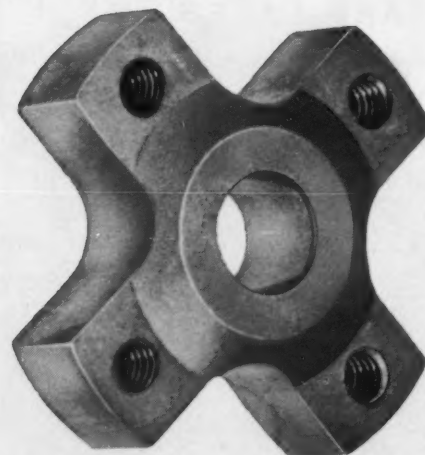
puts a customer in clover

This engine fan-pulley hub was formerly a solid circular casting. The manufacturer had to machine the face, bore the ID, drill and tap four holes. The Amplexologist designed the present cloverleaf shape to reduce weight and material cost. Now produced by powder metallurgy, the hub requires no machining—except tapping the holes. Total savings 33%. Sound interesting? Call the Amplexologist.



### AMPLEX

DIVISION  
CHRYSLER  
CORPORATION  
DETROIT 31, MICHIGAN



SEND FOR THE SECRET  
OF THE  
AMPLEXOLOGIST'S SUCCESS

1 ENGINEERING MANUAL  
45 pages of technical information: How to determine correct applications for powder metal parts, bearings, filters.

2 NEW BEARING STOCK LIST  
20 pages. 1066 standard sizes of Oilite self-lubricating bearings—bearing material. Selection guide, engineering data.

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DESIGN NEWS—MAY 8, 1961

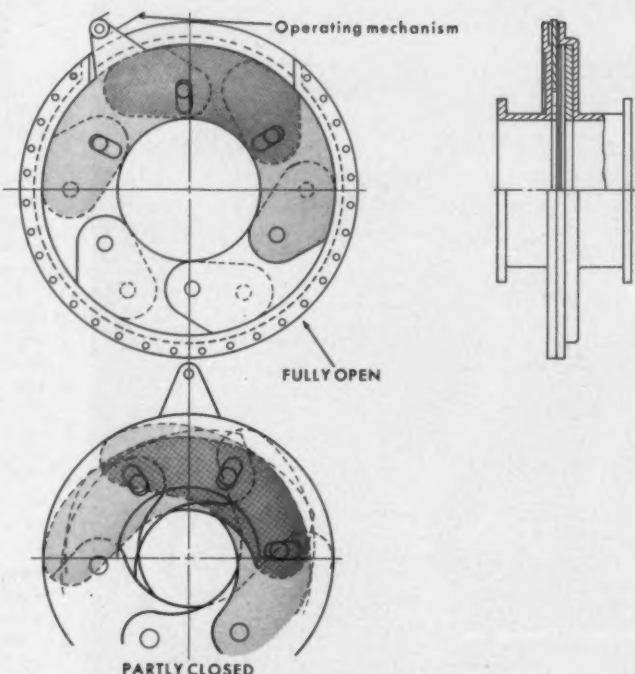
Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

## AVAILABLE

### Regulating Valve

This device could be used in at least two ways. The most probable use would be as a replacement or substitute for butterfly valves to control the rate of flow of gas through a pipe. A second use is as an adjustable orifice plate in a pipe carrying steam or a gas which has a fluctuating pressure that renders a fixed-size orifice hole inaccurate for metering purposes.

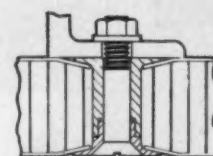
The design is copied from that used to regulate the light which enters through the lens of a camera. It also could be used as an air-inlet valve for regenerative furnaces which rely on "draft" to pull air into the regenerators in order to preheat it and thereby conserve fuel. Wish to sell or license. Write IM 506, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



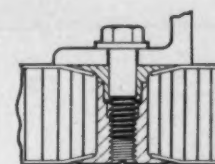
# HONEYCOMB and sandwich panel FASTENERS

PATENT PENDING

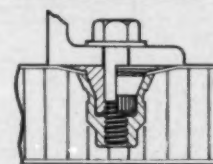
by **Delron**



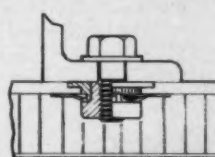
**GROMMET FASTENER**  
Series 101 and 102  
Thru-Rivet and Thru-Bolt Type



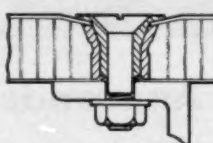
**GROMMET FASTENER**  
Series 103  
Series 104 (Self-Locking)



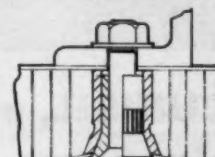
**BLIND FASTENER**  
Series 293  
Internal Thread Blind Type



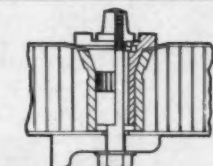
**BLIND FASTENER**  
Series 293K  
Threaded Clinch Type



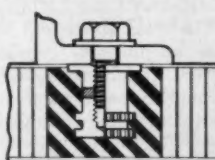
**STRUCTURAL FASTENER**  
Series 600 Flared  
Thru-Rivet and Thru-Bolt Type



**STRUCTURAL FASTENER**  
Series 600 Regular  
Thru-Rivet and Thru-Bolt Type



**STRUCTURAL FASTENER**  
Series 700  
Floating Locknut Type



**MOLDED-IN INSERT**  
Series 404H  
Blind Molded-in Type

Illustrated are only a few of the many available types of Delron Sandwich Panel Fasteners. Write for complete Technical Data.



**STRUCTURAL PLASTIC FASTENER**  
Series 680  
Internal Thread Type



**THE DELRON COMPANY, INC.**

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CAMDEN 1, NEW JERSEY



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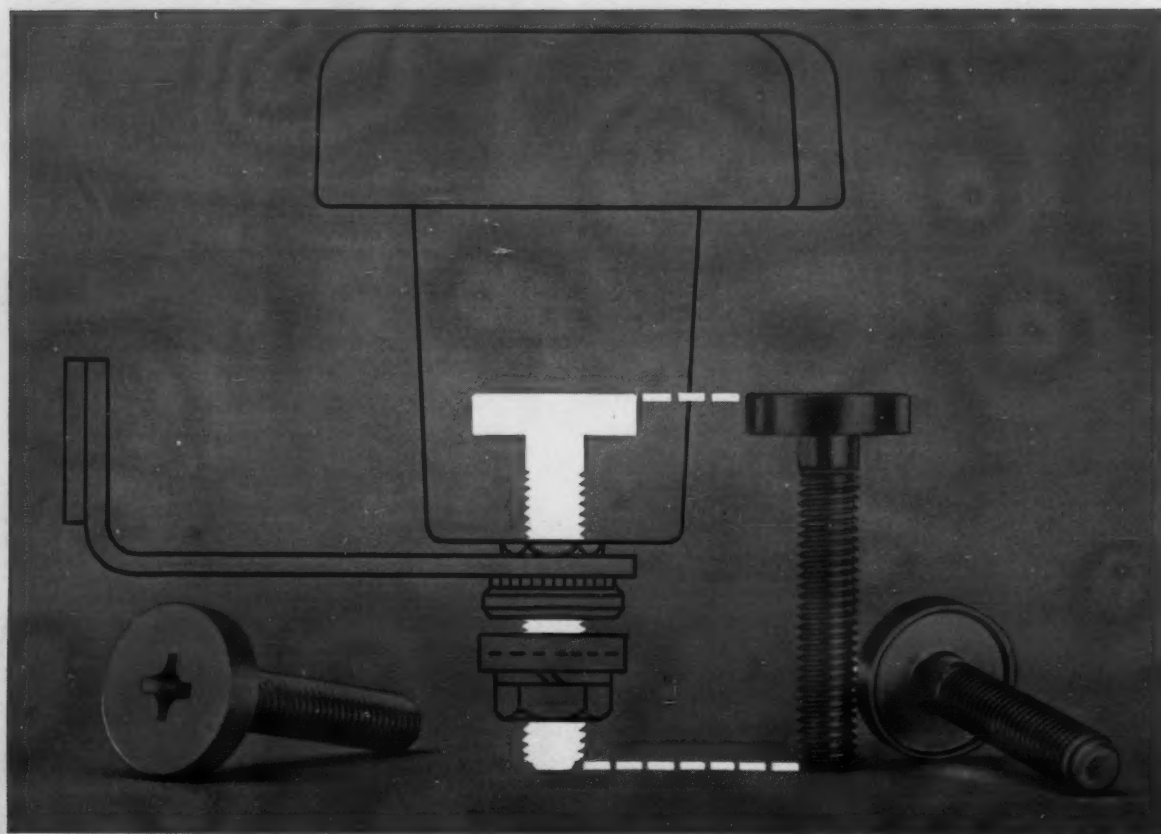
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Circle 43 on Reader-Service Card for more information

DESIGN NEWS—MAY 8, 1961

Circle 45 on Reader-Service Card for more information





## CUNISIL, new Anaconda copper-nickel-silicon alloy, gives you high strength for tough electrical jobs

**THE PROBLEM:** The studs for Line Materials Secondary Class Lightning Arresters (illustration above and below left) call for an unusual combination of properties. They must have high physical strength for structural reasons and to handle the stresses of high surge cur-



**LINE MATERIALS** Type S-3 Secondary Class Arrester with stud of Cunisil, copper-nickel-silicon alloy. Cunisil is also used for lower studs of Line Materials Protective Caps.

rents. Yet they must also have relatively high electrical conductivity. And for economical fabrication, the alloy must have good cold-forming characteristics and be readily machinable.

**THE SOLUTION:** Continental Screw Company, which makes the studs for Line Material Industries, found the answer in Cunisil-837, Anaconda's versatile new high-strength, heat-treatable alloy with these valuable properties in the precipitation-hardened condition:

<b>Tensile strength</b> —psi min.	90,000
<b>Yield strength</b> —at .50% extension under load, psi min.	70,000
<b>Elongation</b> in 4 x D, min.	8%
<b>Machinability</b> , (Free Cutting Brass=100)	40
<b>Electrical Conductivity</b> , % IACS, as heat treated	30 to 42

In addition, Cunisil-837 has corrosion resistance comparable to copper and Everdur® copper-silicon alloys—and is easy to work cold before heat treatment.

**METALLURGICAL COMMENT.** Most of the nickel and silicon in heat-treated Cunisil is present as an intermetallic compound, nickel silicide, and it is the precipitation of nickel silicide in the form

of particles of submicroscopic size by a relatively low temperature heat treatment that accounts largely for the distinctive properties of the alloy.

Prior to the hardening heat treatment, the alloy is brought to a proper condition for hardening with a solution anneal at a much higher temperature and then a water quench from this temperature; at this stage the alloy is quite soft and in a condition for drastic cold-working operations. The hardening heat treatment consists of heating at a controlled temperature for a definite length of time to obtain the desired mechanical properties.

**For more information**—see your Anaconda American Brass representative, or write: Anaconda American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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## IDEA MART

### AVAILABLE

#### Acceleration Governor

This governor takes the form of a coupling or clutch resembling a shoe clutch or shoe brake. Shoes, which have a friction-material lining, operate inside a drum. Power is transmitted from mounting plate to shoes, then to drum by friction contact.

Springs provide the initial applying force while additional force is provided by action of centrifugal force on the shoes.

The unique feature of this device is its response to excessive acceleration. At the center of the device, a doughnut-shaped weight is pivotally mounted on the hub. Should excessive acceleration occur in the counterclockwise direction (direction of the arrow), the weight will have a tendency to resist the acceleration, thereby setting up a movement relative to the mounting plate in the clockwise direction.

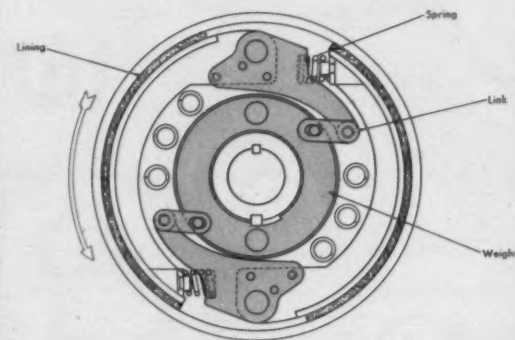
The clockwise movement transmits load through links to arms attached to the shoes, pivoting each shoe about its anchor pin and lessening frictional contact of the shoe with the drum. This reduced pressure permits momentary slipping during the period of excessive acceleration only. Residual friction plugs are provided to dampen out minor movements of the weight.

We have designed two types of clutch couplings which are exclusively responsive to acceleration (both employing inertia weights) and also a clutch-type coupling which is responsive to a combination of acceleration and overspeed.

We feel that various uses might be found for the acceleration governor. However, it was designed to be used with an automotive constant-speed accessory drive.

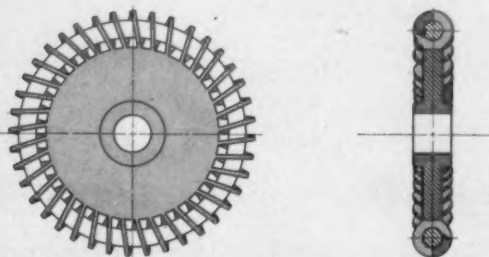
V-belt drives have been used in numerous automobile installations. Why not employ sheaves which vary in diameter to secure a constant-speed drive? The inherent trouble with variable V-belt sheave arrangements is that engine speed may change from low to high in a short period of time. It is very difficult to change sheaves from a 2:1 ratio to a 1:2 ratio in the same short interval.

We have found that by using the acceleration governor, a period of three or four sec may be provided to make the necessary change in sheave diameters without damaging the belt. This points out one use in which the acceleration governor may find application. Write IM 503, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



AVAILABLE

### Regenerative Turbine-Pump Impeller



This impeller is a development resulting from many years of work on pumps of this type. In a regenerative turbine pump, the water or liquid being pumped is turned back into the vanes of the impeller many times to generate a higher and more efficient pressure head.

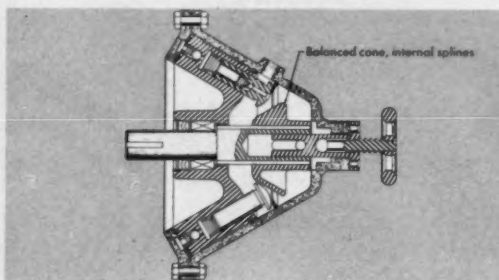
The raceway for this type of impeller should be designed closer to the impeller vanes than has been the practice in standard turbine pumps of the regenerative type. The difference in the circumference of the raceway around the pump impeller makes up for the difference in volume over standard turbine-pump raceways, but is more effective in suction and pressure delivery.

In manufacture, the vanes of this pump impeller are wrapped around a pulley-like blank and butt-welded to form the impeller assembly. The closer the screw-like vanes, the greater the pressure head generated, up to a certain number per inch.

Impellers of this type will generate up to 300 psig in a single stage or deliver water in a well from a depth of 600 ft.

I consider this an important advance in regenerative turbine-pump design and desire to find a manufacturer to incorporate this impeller in a line of pumps with my assistance. Write IM 505, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

### Variable-Displacement Pump



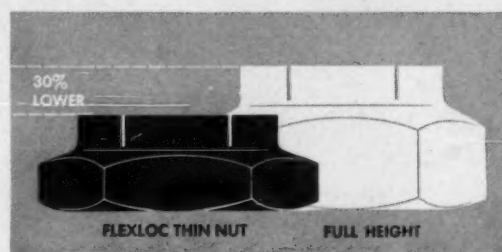
**Purpose:** To simplify design and operation of a variable-displacement hydraulic pump by using a novel offset driving cone.

**Design:** A splined shaft carries an internally splined beveled cone which in turn engages pistons with varying amounts of thrust for varying piston strokes. Because the beveled cone is off center, it can be located to provide no piston stroke (as shown in illustration). By turning the handle at right end, cone is moved forward so that it engages one piston at a time to provide increasing displacement. Write IM 507, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



## SMALL WONDER: FLEXLOC THIN NUT

**30% lower and lighter, yet still stays put for keeps!**



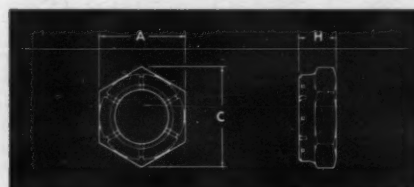
Frequently you need a smaller, lighter locknut, yet you can't afford to sacrifice one whit of holding power. That's where self-locking FLEXLOC thin nuts come in.

Since they are 30% lower than full height locknuts of the same diameter, FLEXLOC thin nuts allow you to design more compact bolted joints. They often fit into space where clearance is insufficient for standard height nuts. Also, thanks to minimum projection, they improve appearance and increase safety.

And FLEXLOC thin nuts save precious weight—they themselves are 30% lighter and you save additional weight by using shorter bolts or studs.

What about reliability? FLEXLOC thin nuts won't budge, even in the face of impact or vibration. This is because every thread, including those in the locking section, carries its full share of the tensile load.

FLEXLOC thin nuts also . . .



- Simplify design—1-piece fasteners (no auxiliary locking elements required)
- Save production time—fewer turns needed to seat
- Lock without seating—serve as stopnuts as well as locknuts
- Can be readily removed and repeatedly reused
- Available in stainless as well as alloy steel

FLEXLOC thin nuts come in sizes from #6 to 1½ in. For complete information, see your authorized SPS distributor or write Standard Pressed Steel Co.—manufacturers of precision threaded fasteners and allied products in many metals, including titanium—for Bulletin 2339. INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 6, PENNSYLVANIA.

**SPS**

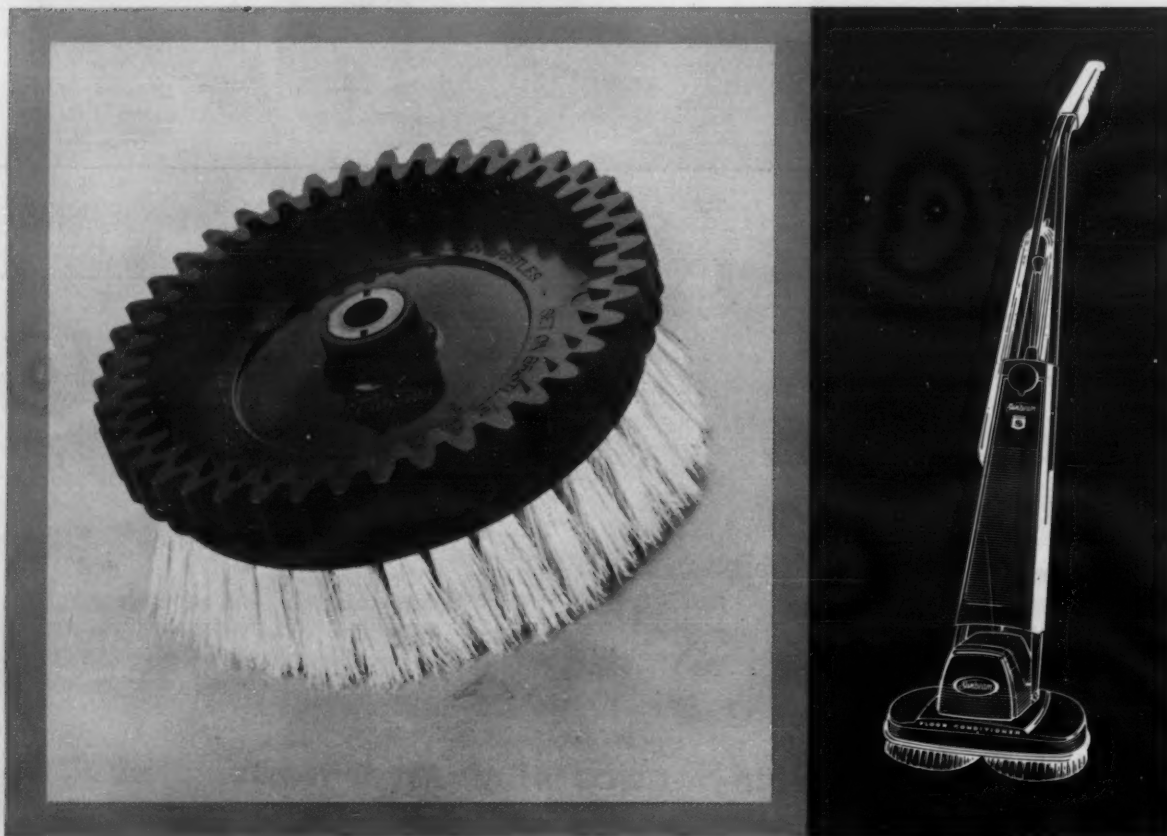
where reliability replaces probability

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## Naugatuck KRALASTIC

THE ORIGINAL ABS RESIN



\*Manufactured by Prolon Plastics, Florence, Mass.

### Cleans up against materials costing twice as much

Sunbeam Corporation ran exhaustive tests to choose a bristle-head\* for the brushes in its new floor cleaner-waxer. Kralastic® MM excelled...outperformed products costing twice as much. Let's see why...

The cleaner-waxer has two brushes: one is driven by a pinion through its internal gear and, in turn, drives the other through its external gear. Here's where Kralastic made the difference. Kralastic's superior dimensional stability and toughness insure constant transmission of power, its self-lubricating properties cut friction, its abrasion resis-

tance minimizes wear from gritty floor-cleaning compounds.

Kralastic takes high-speed punishment, absorbs jarring impacts. What's more, water and cleaning compounds can't damage Kralastic. It won't rust, resists chemical attack. And lightweight Kralastic parts can be injection molded...need no finishing...are interchangeable.

Learn more about Kralastic, the hard, tough plastic material that has proved itself in applications from 16,000 miles of underground pipe to automotive instrument clusters. Call or write us:



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## PATENTS

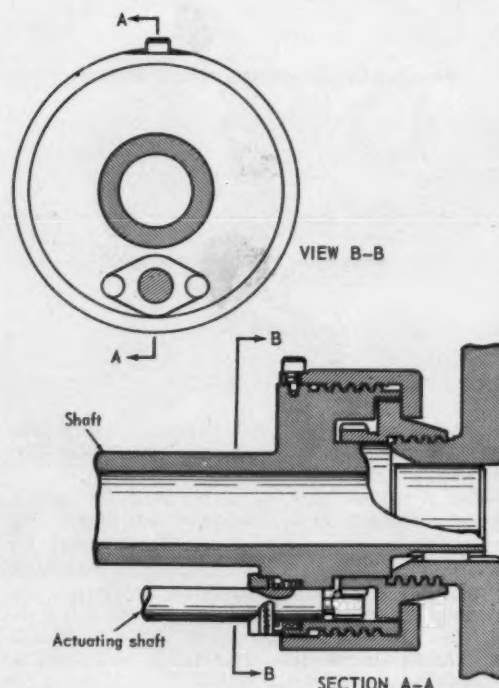
### Quick-Disconnect Joint

U. S. Patent 2,967,069; Trent H. Holmes, assignor to United Aircraft Corp., East Hartford, Conn.

This joint is normally locked against accidental operation. It can be quickly unlocked by an actuating shaft. The particular joint illustrated is for connecting a hollow shaft to a vessel. The casing of the vessel has a cylindrical boss with external threads. The shaft has an enlarged portion of cylindrical shape with external threads on which a nut retaining cap is threaded. The cap has an inward flange which provides an annular recess when combined with the enlarged portion of the shaft.

An annular connector, or nut, has a radial flange which fits in the recess. The nut is held against axial displacement by the cap but is free to rotate and engage the threads on the boss. The cap is held against rotation by a screw threaded into the enlarged portion of the shaft.

The annular nut is also provided with external gear teeth which mesh with gear teeth on a pinion on an actuating shaft, which is biased outward by a spring. Ratchet teeth are provided on a collar integral with the actuating shaft and also on a plate attached to the enlarged portion of the main shaft.



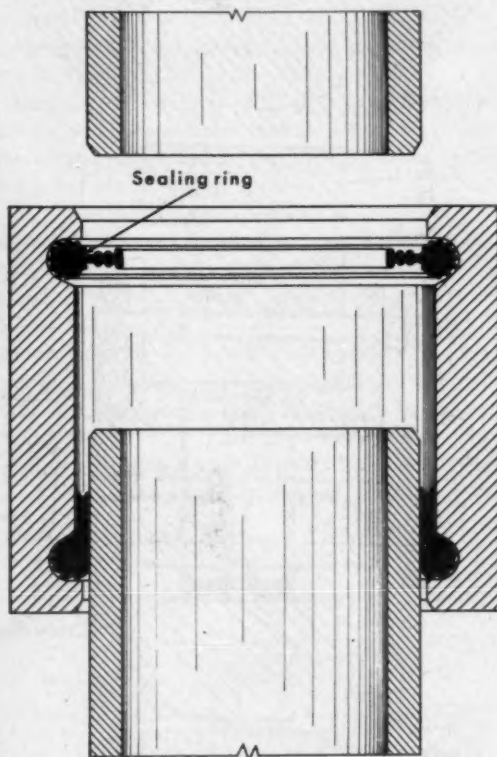
DESIGN NEWS—MAY 8, 1961

## Pipe Coupling

British Patent 847,210; Societe Anonyme Eternit, Kapelle-op-den-Bos, Belgium.

Ribs formed on resilient rings and housed in end grooves in a sleeve member are compressed when this pipe coupling is assembled. Each ring has a toroidal backing portion from which a web extends inward. Annular ribs project from both the backing and the web, including the inner edge of the web.

When a pipe is inserted into the end of the sleeve, webs are bent from their initial position



to a position parallel with the longitudinal axis of the sleeve. Fluid pressure in the coupling compresses the webs and ribs against the adjacent sleeve and pipe walls and deforms the ribs to make sealing contact with the respective surfaces. Simultaneously, the ring toroidal portions are pressed into the sleeve grooves, which are shaped with inclined inner and flat outer walls to retain the rings.



## BENDIX ELECTROMAGNETIC TOOTH CLUTCH

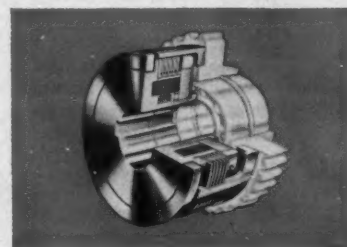
Where space is a problem, design engineers can give their products a competitive advantage by specifying the Bendix® Elmag tooth clutch. It transmits the same torque in a smaller size "package" than other clutches, and is controlled by remote electrical switches or relays.

Thus, the engineer can design for the same torque in less space, or for more torque in the same space. Simple, bolt-on design, unhampered by cumbersome linkages and disengagement mechanisms of mechanical clutches, virtually eliminates design problems in mounting the clutch.

The clutch can be engaged at relative speed, disengaged at any RPM under full load. Once disengaged, there is absolutely no idle torque—no connection

between driving and driven members. The Elmag tooth clutch performs in either wet or dry applications. Most models available from stock in torque capacities of 40 to 4,000 ft.-lbs. Diameters, 3.000" to 9.055".

**BENDIX ELMAG MULTIPLE DISC CLUTCH**—Ideal for step-by-step acceleration of large masses. Disc stack is magnetically isolated. Wet or dry operation. Slip ring or stationary field design. Torque capacities: 10 to 16,000 ft.-lbs. Diameters: 3.93" to 22.04".



For full details, write

**Bendix-Elmira**

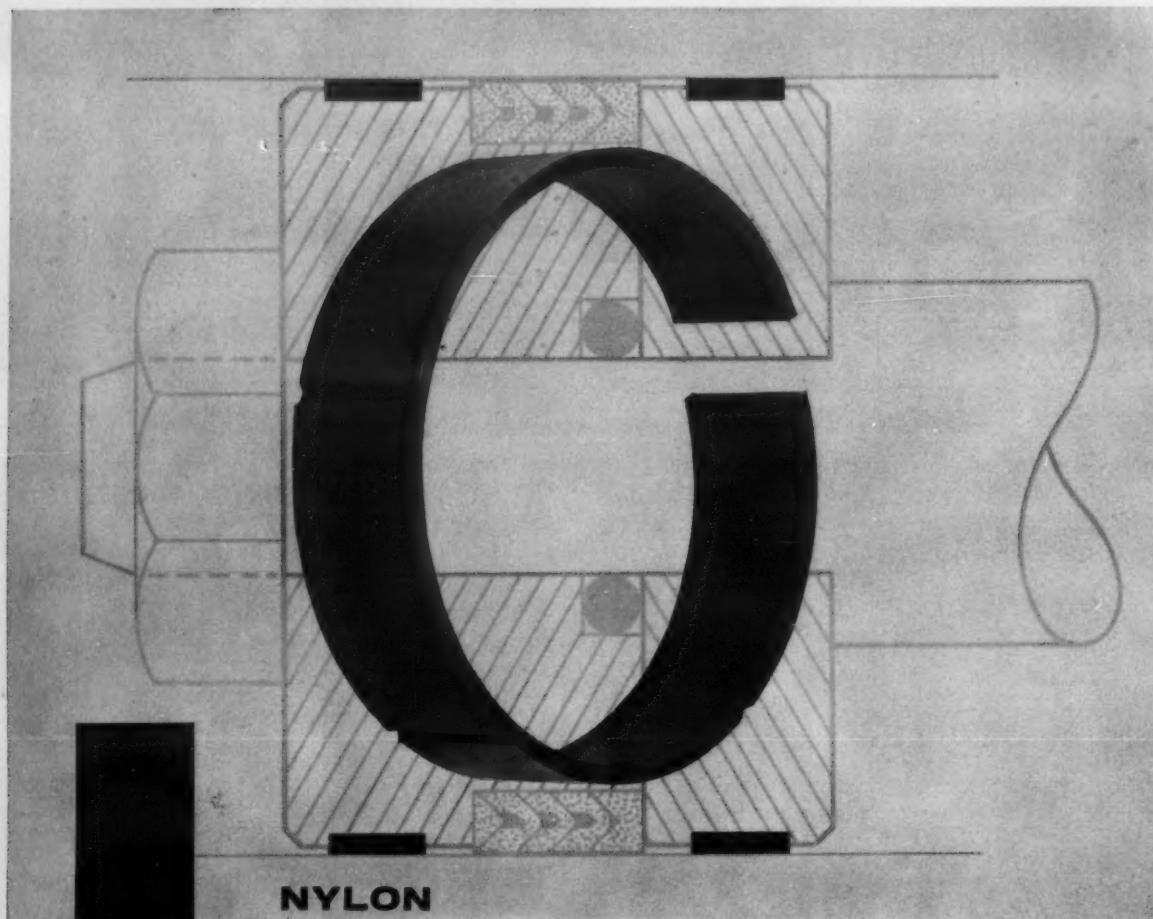
Eclipse Machine Division  
Elmira, New York



Visit Bendix Booth No. 1149  
**DESIGN ENGINEERING SHOW**  
Detroit, May 22-25

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## NYLON WEAR RINGS for Hydraulic- Pneumatic Service

**New—prevent damage to piston cylinders with new Garlock Nylon Wear Rings.** Greatly superior to materials previously used, the rings (designated Style 9003) are smoother and harder. This means that no foreign particles in the cylinder can be picked up or become imbedded in the ring and consequently score the cylinder walls. For you, it adds up to smooth, unhampered piston operation, greater overall efficiency, and longer cylinder and packing life.

**Offer all the fine advantages of Nylon.** Garlock Nylon Wear Rings provide satisfactory service in temperatures as high as +350°F. They are unaffected by the normal fluids used in hydraulic cylinders. They exhibit greatly-improved wear qualities and life expectancy. Garlock Nylon Wear Rings are available in a wide range of sizes for new equipment, and will normally fit existing grooves in present equipment. You can order Nylon Wear Rings in nominal diameters (inches) from 2.005/2.010 to 7.005/7.015, and in widths (inches) from .500/.490 to .625/.615, depending on diameters. Special sizes also available.

**For more information, call your local Garlock representative.** He is at the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-179. Garlock Inc., Palmyra, N. Y. Canadian Div.: Garlock of Canada Ltd. **Plastics Div.:** United States Gasket Company. **Order from the Garlock 2,000 . . .** two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

As bearings to prevent wear between piston and cylinder (top), Garlock Nylon Wear Rings are gaining fast acceptance among leading manufacturers of hydraulic-pneumatic equipment, such as Hough Loaders (below).

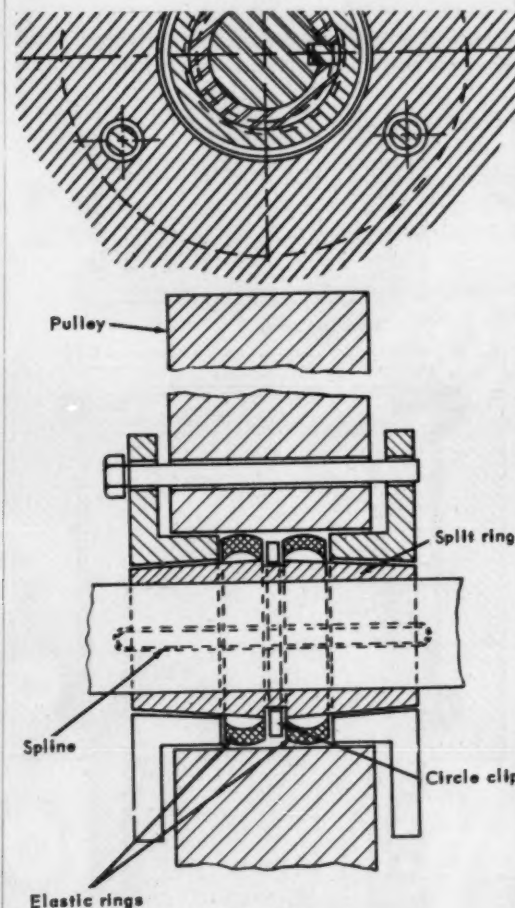


## PATENTS

### Pulley Mounting

French Patent 1,243,387; Demetre Papageorges, Bruxelles, Belgium.

This patent covers a friction assembly for mounting a pulley on a shaft. Flanges of the pulley are split so they can expand when bolts which traverse both flanges and pulley are tightened. Flanges slide on a doubly tapered ring retained



on the shaft by a split spline arrangement. A circle clip is mounted on the tapered ring. Two identical elastic rings are mounted between the flange ends and the circle clip. The elastic rings push the flanges apart when bolts are loosened and thus simplify dismantling of the unit.

# GARLOCK

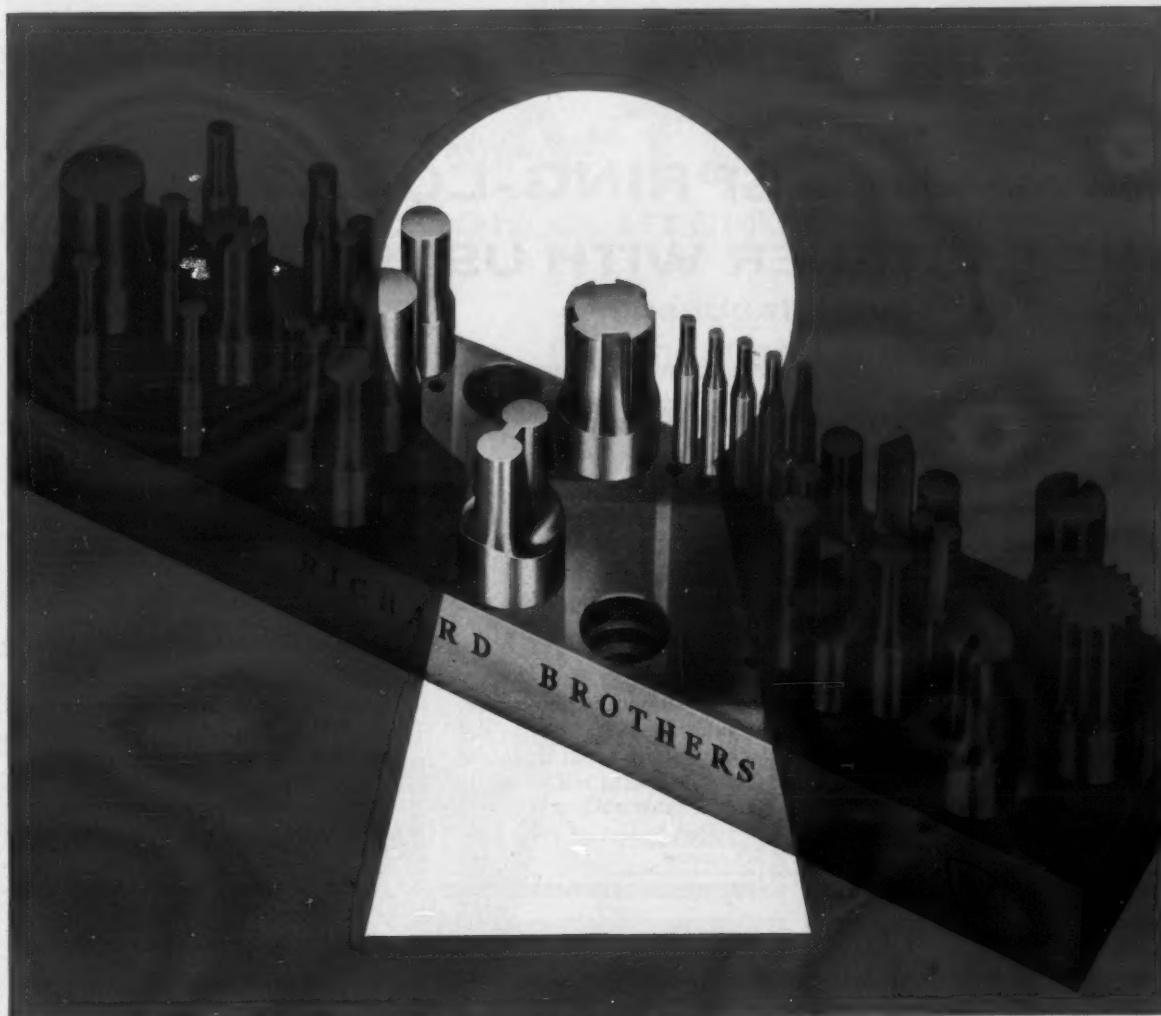
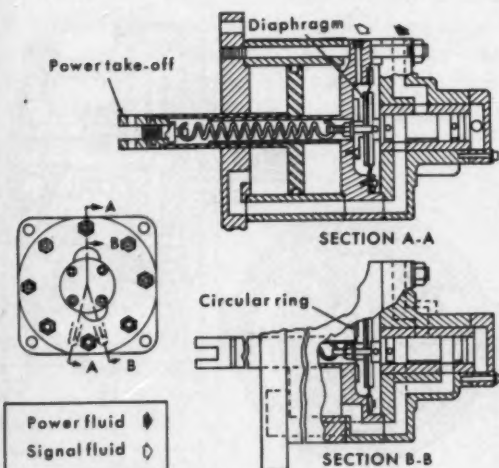
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## Simplified Power-Relay Assembly

U. S. Patent 2,966,891; John G. Williams, Springfield, N.J.

This power-relay device responds to low power-input signals. An outer casing structure is formed with a cylinder. A cylinder-head casing is connected by bolts and defines a cylinder-head chamber to the right of the cylinder. A pair of telescoped sleeves is placed transversely; the inner sleeve is stationary in a head plate at one end of the cylinder, and the outer sliding sleeve with a power-takeoff end extending through an opening in an end plate is at the other end of the cylinder. A piston on the outer sleeve divides the cylinder into two chambers. By selectively admitting power fluid, such as high-pressure air, to one of the chambers while exhausting the other, a flow-control valve (not shown) can be operated.

Pressure air also is used as the signal fluid, although of a substantially smaller magnitude than that of the power fluid. The cylinder head plate is formed with stepped surfaces. A circular ring with a flexible middle portion is connected to one surface while a diaphragm is connected to the other stepped surface. Within the cylinder-head chamber, a signal-fluid pressure chamber is formed between the circular ring and diaphragm. Signal fluid is delivered continuously to the chamber through a radial passageway in the cylinder-head plate. As a result, variations in signal-fluid pressure will cause movement of the element or diaphragm in a direction parallel to the longitudinal axis of the telescoped sleeve.



## KEY TO EFFICIENT, ECONOMICAL OPERATION

In any sheet-metal piercing operation where frequent tool change is required, Richard Brothers standardized interchangeable tooling can be the key. Complete interchangeability of standard or special punches and die buttons within the same RB retainers saves time, cuts costs.

You save design time by applying RB standardized features. You save die construction time because RB tools are ready to use. You save press down-time because RB tools are so easy and quick to change—yet positive alignment is assured. And Richard Brothers tools meet the highest standards of the industry because of the finest quality control of materials, heat treating, machining and inspection.

Specify Richard Brothers punches, die buttons and retainers for more efficient, economical operation.



QUALITY



RELIABILITY



INTERCHANGEABILITY



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## How can you use **SPRING-LOCK?** THE FASTENER WITH USES UNLIMITED



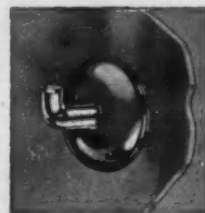
### As a standard removable fastener or a blind rivet

A quarter-turn locks, unlocks. Load-carrying steel arms lock securely, don't loosen under vibration. One-piece (no receptacle) simplifies blind fastening.



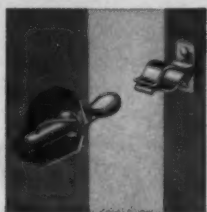
### As a roller axle

Now used on range drawers, kitchen cabinets, file cabinets, desks. Cuts installation costs, saves time. Designed to suit. Available with or without roller.



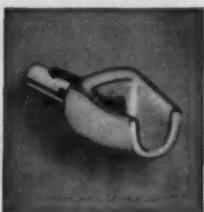
### As cup hooks

High-strength polystyrene or chrome-plated die cast zinc. Inexpensive, sturdy and good-looking. Simply and quickly installed with a twist of the wrist.



### As a cabinet door strike

Millions in use on kitchen cabinets, automatic dishwashers, etc. Standard strikes available from stock, or custom designed for special contour requirements.



### As a plastic shelf support

... with the heart of steel for extra strength. Millions now used by all major refrigerator manufacturers. Complete flexibility of head design.

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## PATENTS

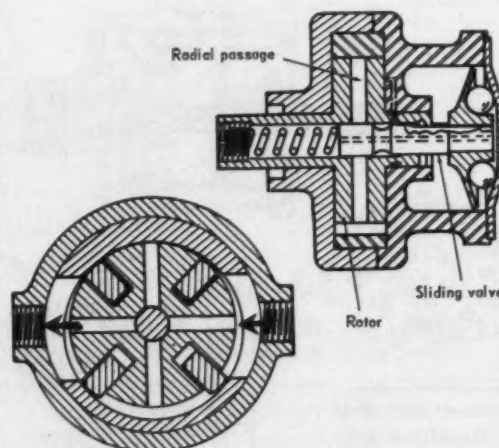
### Controlled-Output Rotary Pump

British Patent 816,967; Walter H. Briggs, Burman and Sons, Ltd., Kings Norton, Birmingham, England.

The rotor of this pump embodies an axial bore in which a sliding spring-loaded valve, controlled by a centrifugal ball governor, automatically limits maximum output. On reaching a predetermined speed, increased output is prevented by diverting liquid to establish a return flow from high- to low-pressure working chamber zones. Idle circulation of the liquid is set up within the pump, thus restricting or preventing discharge.

Restriction is achieved when the governor operates to move the plug-type valve axially against its spring. A circumferential groove around the valve is brought into line with four radial passages in the rotor to interconnect them. An axial vent in the valve member permits discharge of liquid trapped in housing containing spring.

Internal surface of the working chamber is shaped to provide two opposite concentric portions of different radii, but blended into one another. With its radius equal to the smaller portion, the rotor has four radial passages communicating with the rotor spindle bore. Between these passages are four slots, each containing a radially sliding vane. The plug-type valve operating in the rotor spindle bore has an axial vent, through which any liquid trapped in the space housing the spring is discharged. A dished disc inclined to the spindle axis is free to slide on the spindle. A corresponding, inclined cover plate is provided on the pump cover adjacent to the disc. The governor balls are contained between the inclined surfaces.

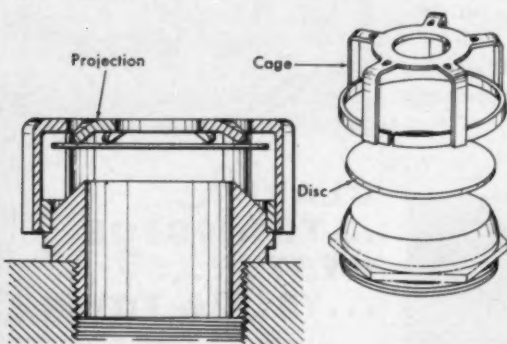


## Gravity Disc Valve

British Patent 851,504; Keith Spinks, British Oxygen Gases, Ltd., Bridgewater House, Cleveland Row, St. James, London, S.W.1., England.

The spider-type cage in this nonreturn disc valve is formed with radiused, pointed projections. The disc is held by pressure against the projections and is prevented from tilting.

Valves of this type have a tendency to stick in the open position because the disc becomes moist during use and adheres to the cage. This difficulty is overcome in this design because contact surface area between cage and disc is minimized.

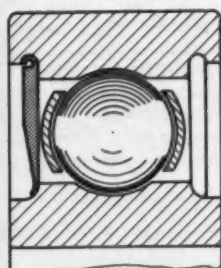


## Bearing Seal and Shield

British Patent 852,993; Kenneth S. Vernon, Burtonwood Engineering Co., Ltd., Burtonwood, Warrington, Lancashire, England.

This inexpensive plastic-bearing grease seal is said to provide the advantages of the more complicated metal-reinforced seals. In the form of a ring, it consists of a stiff body section, a tapered, flexible, inner sealing lip and a slightly less resilient outer U-shaped portion.

When the seal is fitted into its locating groove in the bearing outer race, the U-shaped portion is deformed and a radial stress is imposed on the whole ring. The stiff section remains in the same plane despite any slight axial sealing-lip displacement caused by pressure contact against the curved, inner-race seat.

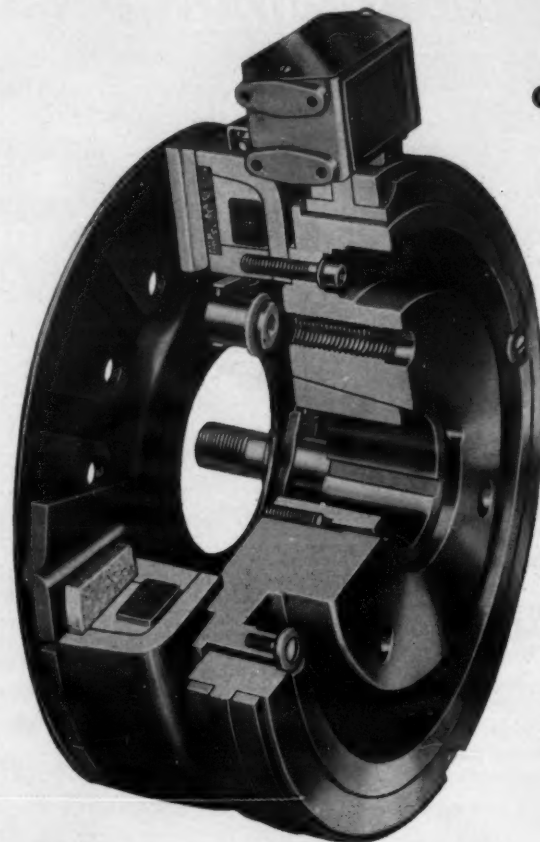


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## MAGNETIC-FRICTION CLUTCHES and BRAKES

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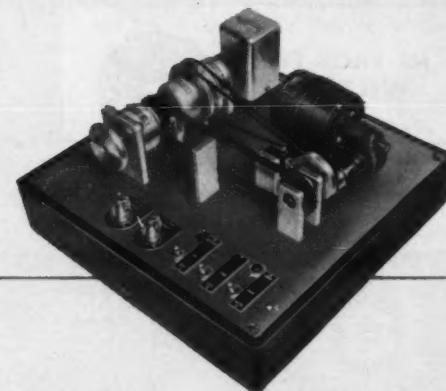
These highly responsive, trouble-free units provide accurate control of intricate automatic machinery. Operating on 6, 12, 24 or 90 V.D.C., Dyna-torQ units may be actuated by micro-switches, photoelectric cells, relays or any "ON-OFF" signal to perform a wide range of functions in processing and fabricating applications. The compact rectifier type control converts AC power to DC power and may be remotely mounted out of busy machine areas.

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HP @ 1800 R.P.M. (Typical Application)

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303	1/5	310	10
304	1	312	20
305	2	315	25

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Ask your Dyna-torQ Distributor to demonstrate Dyna-torQ in action and see for yourself the many possible applications for Dyna-torQ in Motion Control and Power Transmission.



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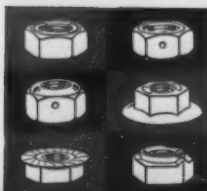
# EATON

DYNAMATIC DIVISION  
MANUFACTURING COMPANY  
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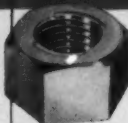


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PRODUCT...

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A free starter with lock at the top.  
Withstands severe vibrations.  
Cuts assembly time.

### MF TWO-WAY



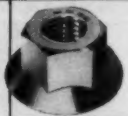
The Lock's in the center of nut.  
Can be applied from either end.  
Permits bolt end to be flush with,  
or below, top of nut.

### MF OPEN END CAP NUT



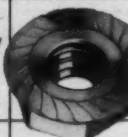
Has two-way center-of-nut lock.  
Used on furniture, appliances,  
toys, lawn mowers, tools, etc.

### MF UNI-TORQUE FLANGE NUT



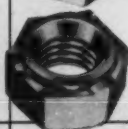
Combination lock nut and washer.  
Use on oversized holes; where  
extra bearing surface is needed.

### MF "WHIZ-LOCK" FLANGE NUT



This one spins on. Serrations take  
a firm grip on work. Break loose  
torque higher than seated torque.

### MF PILOT TYPE WELD NUT



You can have it with or without  
lock. Simplifies assemblies by  
means of self-locating pilot.

CIRCLE NUMBER FOR ILLUSTRATED CATALOG



MAC LEAN-FOGG

# LOCK NUTS

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CHICAGO 40, ILLINOIS

**BOOTH 242  
DESIGN  
SHOW**

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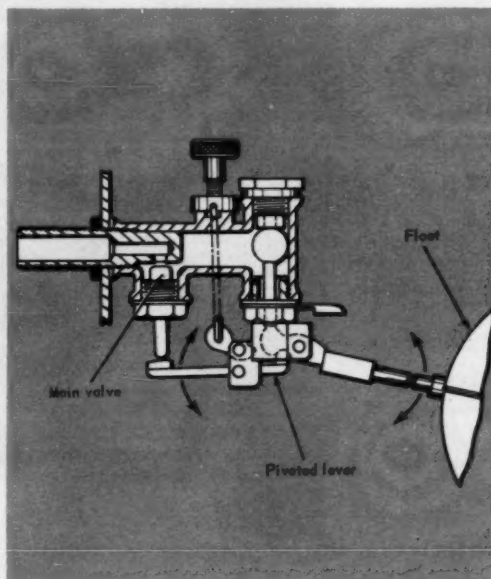
## PATENTS

### Fluid Level-Control Valve

British Patent 820,112; Ernest J. Allman, Mavis Floyd,  
5 Berkeley Sq., Havant, Hampshire, England.

Tank overflow caused by float-valve failure is prevented by this composite valve. A cam on the inner end of the float arm contacts a pivoted lever which closes a main supply valve. When the float rises above a predetermined level, pressure created by the float arm holds the main valve closed until tank water level drops. Pressure on the mechanism is relieved and the main valve reopens.

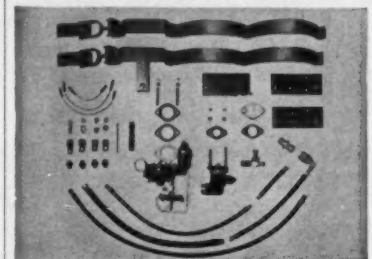
Fluid enters the valve casing through a union which includes the main valve seat. Discharge



from the casing is regulated by the float valve comprised of a rubber ball mounted on a stem. Lower end of the stem passes through a port in a plug, the lower end of which forms the discharge nozzle.

A slotted bracket on the nozzle carries a fulcrum pin for the float arm. In normal operation, the cam on the float-arm end bears on the float-valve stem. If the float rises excessively because of valve leak, the cam engages the adjacent pivoted-lever inner end. The other end then contacts the main valve stem, moving it upward to close the inlet union.

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The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

#### POWER-STEERING MECHANISM

U S Patent 2,977,813; Oscar H. Banker, assignor to Fawick Corp., Cleveland, Ohio.

#### VARIABLE-RATIO LEVER MECHANISM

U S Patent 2,977,817; Anton Z. Panasewicz, assignor to General Motors Corp., Detroit, Mich.

#### VIBRATION DAMPER

U S Patent 2,977,819; Fred L. Haushalter, Pontiac, Mich.

#### FLUID FLOW-COMPENSATING DEVICE

U S Patent 2,977,871; Gerrit E. Euwe, assignor to Lever Brothers Co., New York, N. Y.

#### OVERSPEED SAFETY DEVICES

U S Patent 2,977,831; Donald E. Schott, assignor to Thomas C. Wilson, Inc., Long Island City, N. Y.

#### PRESSURE RELAY

U S Patent 2,977,968; Paul M. Stiglic and Daniel J. Schramo, assignors to Thompson Ramo Wooldridge, Inc., Cleveland, Ohio.

#### RELIEF VALVE

U S Patent 2,977,978; Matthew N. Miller and Roy V. Smith, assignors to Fairchild Engine & Airplane Corp., Hagerstown, Md.

#### DIFFERENTIAL PRESSURE-RESPONSIVE APPARATUS

U S Patent 2,977,990; William E. Bauer, assignor to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

#### SPEED-REGULATING DEVICE

U S Patent 2,978,059; Carl D. Miller, Columbus, Ohio.

#### OVERLOAD-RELEASE CLUTCH

U S Patent 2,978,082; Bernard R. Better, assignor to Scully-Jones & Co., Chicago, Ill.

#### SEAL

U S Patent 2,978,264; Henry H. Campbell, assignor to Borg-Warner Corp., Chicago, Ill.

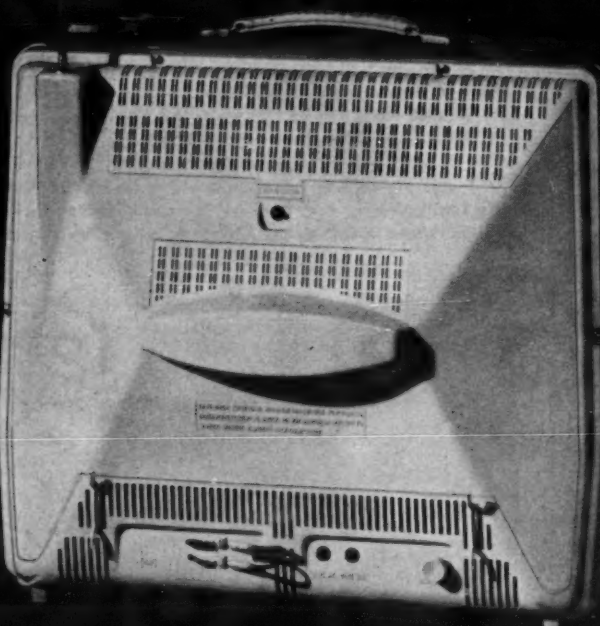
#### QUICK-DISCONNECT COUPLING

U S Patent 2,978,265; Harold E. Cluff, Otto Boettcher, Jr., and Edward L. Gammill, assignors to The Garrett Corp., Los Angeles, Calif.

#### THRUST BEARINGS

U S Patent 2,978,281; Ronald S. Hayward, assignor to Collaro, Ltd., Barking, England.

there are always  
good reasons for  
designing it in  
**AVISUN**  
polypropylene



AviSun Polypropylene's good molding characteristics permit an intricately vented back with cross-members less than 1/8 inch wide. Custom-molded by Sinko Manufacturing & Tool Co.

in TV backs  
*it's toughness,*  
*heat resistance,*  
*good insulation*

Styling is most important in portable TVs. For the backs of their sets, Motorola needed an attractively molded back with good insulating properties, high heat resistance, and tough enough to stand hard bumps. Only polypropylene could meet their quality specifications. The back, molded in one piece from AviSun #1014, is warp-free, economical to manufacture, and easy to assemble.

*Polypropylene makes better products at lower cost. No other material has this combination of properties:*

1. Heat Resistance
2. Chemical Resistance
3. Toughness
4. Economy

AviSun polypropylene is being used in new applications every day—from Pulsators to TV backs. New production facilities, now under construction, will soon be ready to meet the growing demand for this versatile new material. Send for Booklet AP-601, giving complete information on AviSun polypropylene.

**AVISUN CORPORATION**  
Dept. 441  
1345 Chestnut St.  
Philadelphia 7, Pa.

\*a trademark of AviSun Corp.



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See this design idea in the DESIGN NEWS Booth No. 756

## Versatile Long-Stroke Actuator Uses Induction Motor Principle

Victor W. Wigotsky, Eastern Editor

A new electromechanical actuator operates on the principle of an induction motor. The basic design is highly flexible with individual stroke and power requirements for a wide range of applications.

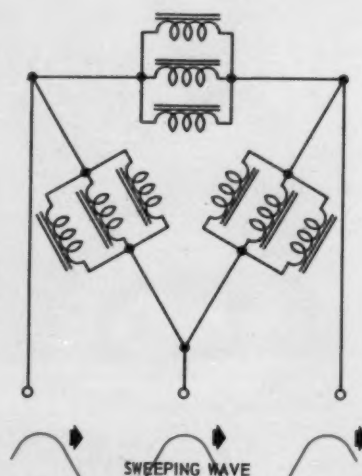
Fundamental feature of the linear actuator is its capability of long stroke with accurately controlled output force and uniform response to energization. The unit also combines some characteristics of a solenoid and some of a hydraulic or pneumatic actuator.

Only one moving part is required in the simple construction. A group of coils is linearly arranged and spaced between teeth. The teeth provide flux paths, bearing surfaces or bearing tube guides for the moving rod and extended surfaces for heat transfer. Wiring of the coils in proper sequence produces a sweeping magnetic wave which travels in a linear path to cause rod motion. The sweep is of constant velocity and can be reversed.

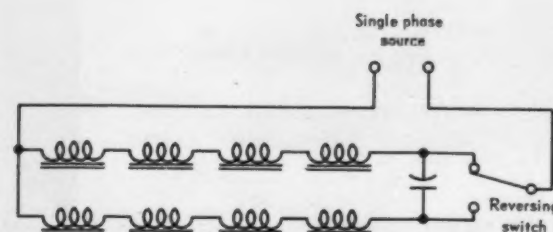
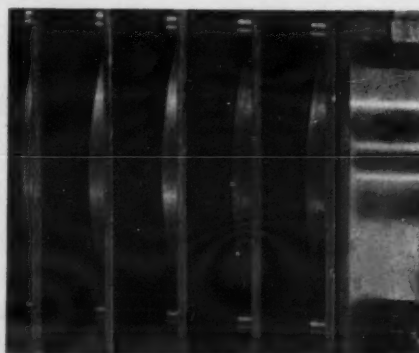
Stroke can be of any length, from zero to full length of the stator, without external bearings. Stroke is almost unlimited if external bearings are provided and stator-rod relationships are maintained. The electrical configuration and power input are constant throughout the length of stroke since the rod remains in the stator during operation. This provides a uniform output force throughout the stroke, with output force directly proportional to input power. The basic flexibility permits a wide range of forces for individual actuators designed for continuous or intermittent duty. These range from less than a pound to a practical maximum of approximately 100 lb.

The actuator can be driven in both directions, since it is an induction device operating from single or polyphase a-c. This eliminates need for return springs and permits uniform reciprocating motion. A shift in phase sequence of the polyphase unit, or a change in capacitance phase shifting of a unit supplied with single-phase power, results in reversal of force and the desired reciprocation.

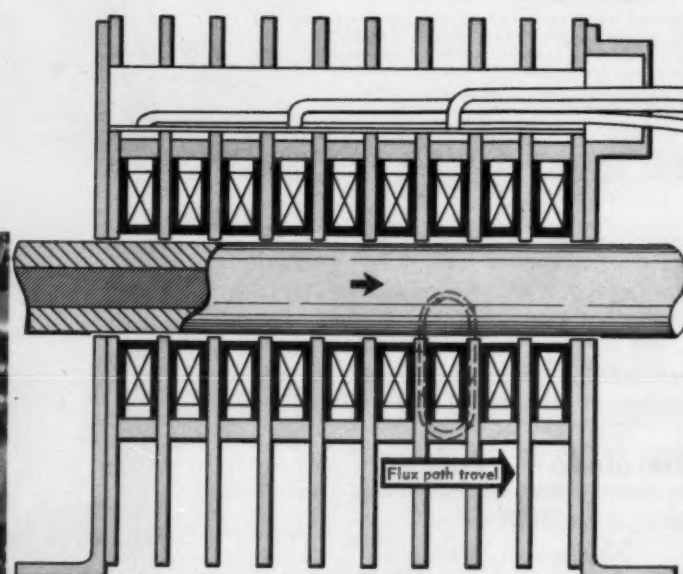
The "Polynoid" linear actuator (patent pending) is designed and manufactured by Skinner Precision Industries, Inc., New Britain, Conn.



TYPICAL 3-PHASE, 9-COIL  
WIRING DIAGRAM

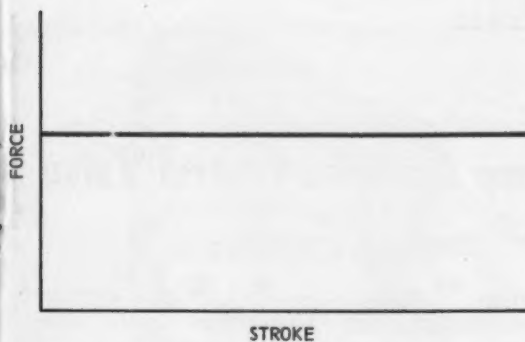


TYPICAL SINGLE-PHASE 8-COIL  
WIRING DIAGRAM

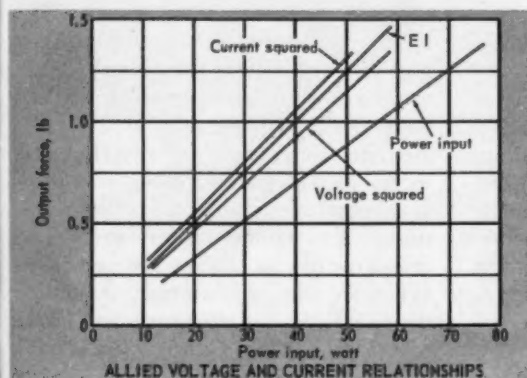


DESIGN IS BASED ON MODULAR CONSTRUCTION. Each coil is wound on molded nylon bobbin. Operation of actuator can be understood by considering coil, with adjacent tooth on each side, as isolated electrical element. Voltage applied to coil causes current flow and creates magnetic field. Magnetic flux lines pass through both teeth, coil housing and rod. Strength of this flux field will change with change in applied voltage. Traveling magnetic field is created by wiring so that adjacent coils reach peak voltage in proper sequence. Rod is continuous iron bar with external copper conductor and is flash chromium-plated to improve wear and friction characteristics. Standard female threads at each

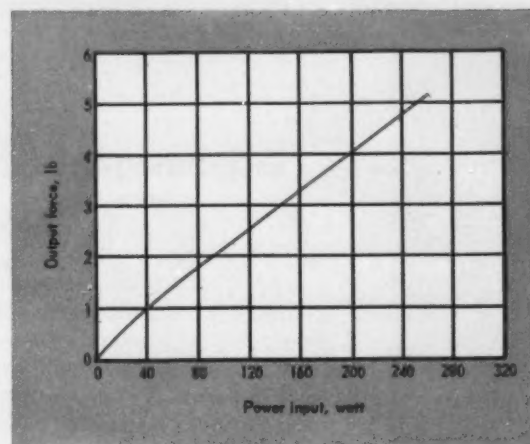
end permit attachments of tools or linkages. Teeth are stamped from cold-rolled steel sheet. Center hole acts as bearing for rod or for insertion of stationary bearing tube. Teeth also provide path for magnetic flux and project beyond coil housing to act as cooling fins, providing continuous conduction path from coil windings and rod to exposed external surfaces. Housing is cylinder of ferromagnetic material and serves as flux path, protection for coil and spacer for teeth. Unit can be foot- or face-mounted in any plane. Actuator now is being built for either continuous or intermittent duty at 220 and 440v, 3-phase, and 110v, single-phase.



RELATIONSHIP of output force to rod position with constant power input.

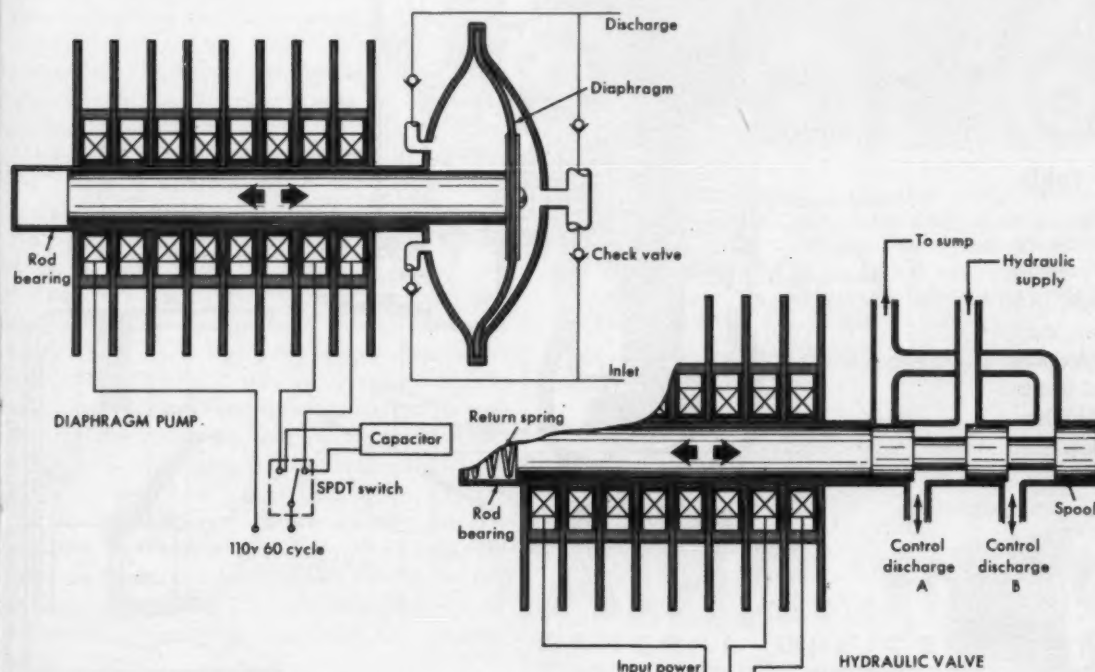


LINEAR RELATIONSHIP of force output to power input.



STATIONARY ROD FORCE OUTPUT to actuator power input. Direct relationship is shown through nearly entire range of operation. Power factor remains constant throughout operating range.

◆ **LINEAR ACTUATOR APPLICATION** with double-acting diaphragm pump. By making rod bearing into pressure wall, pump will need no seals and diaphragm could rupture without leakage of media from system. Discharge volume could be controlled by frequency of switch operation and discharge pressure could be controlled by input voltage to actuator. Linear actuator also offers a number of interesting approaches to electrohydraulic servocomponent problems. One example of where unit might be applied is in hydraulic valves. Drawing shows a spool-type valve which might be used in either servosystems or in cases where remote manual actuation is desired. In either case, unit is sealed and position is related directly to input power to actuator. Actuator allows design with pressure balancing and force output permits direct hydraulic operation with minimum of electrical amplification.



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Kenilworth, New Jersey

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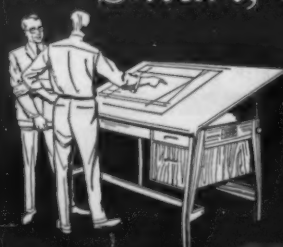
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## IDEAS... ELECTRICAL

### Electromagnetic Pump Actuates Control Valve

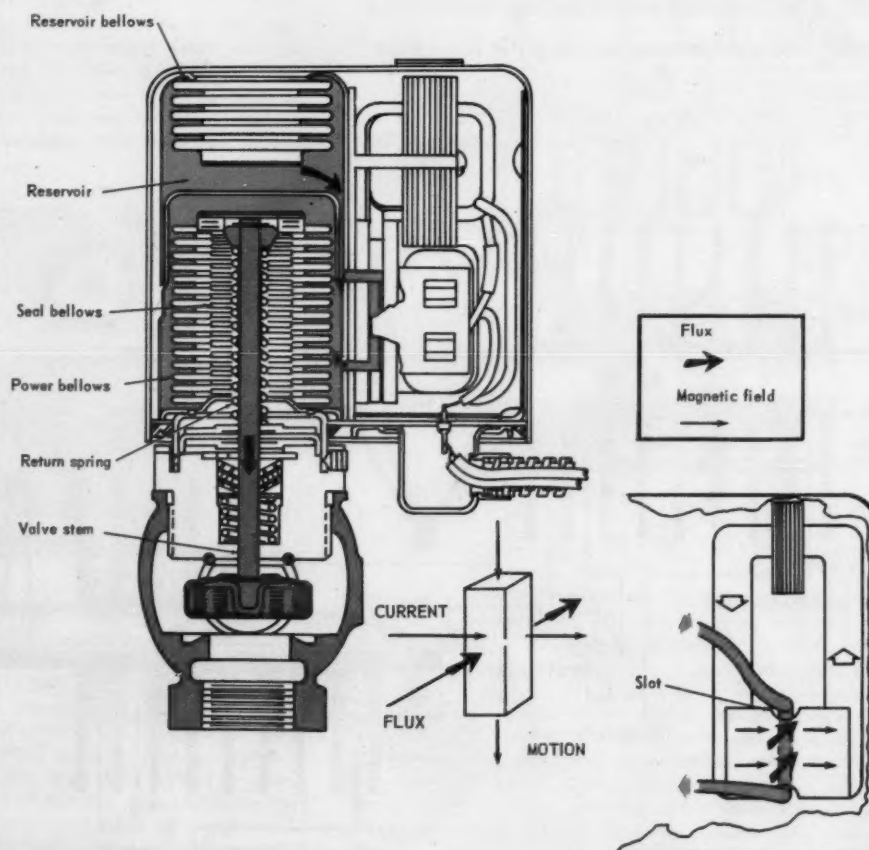
Lars G. Soderholm, Midwest Editor

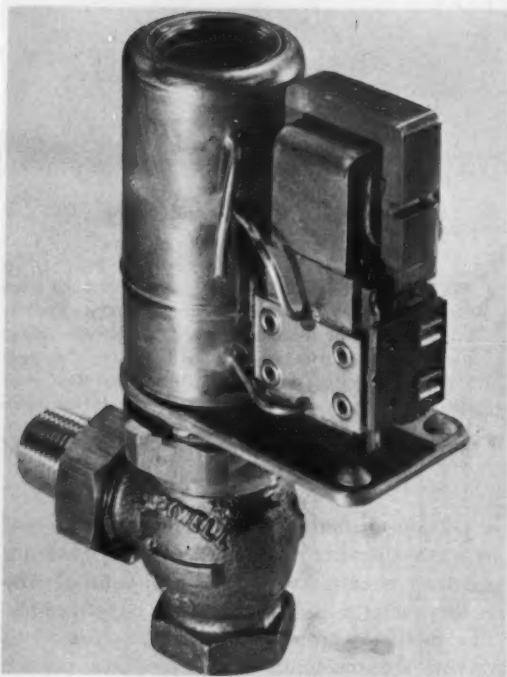
A control valve for water and steam applications is actuated by an electromagnetic pump that causes a flow of liquid metal into a power bellows that positions the valve stem. To operate the pump, a magnetic field set up by the field coil and a high current produced by a transformer create a force that moves the liquid metal at pressures up to 50 psi.

The old basic principle that a current-carrying conductor will move in a magnetic field had only limited practical applications until the Atomic Energy Commission began using large electromagnetic pumps to move hot radioactive metals. These unusual pumps have no moving parts and last indefinitely. Use of this principle to operate a control valve has

resulted in a valve with only three moving parts—a valve stem, a power bellows and the liquid metal itself.

The control valve actuator is divided into two principal parts: a low-pressure liquid-metal reservoir at the top and a high-pressure section at the bottom. Two sets of nested bellows are used in the high-pressure section. The power bellows contains the seal bellows which in turn holds the top of the valve stem. As the electromagnetic pump sends liquid metal to the high-pressure chamber, this force acting against the top of the bellows overcomes that of the return spring and causes the disc to close on the valve seat. When the current is shut off, the return spring lifts the disc off the seat and forces





the liquid metal back into the low-pressure reservoir.

The electromagnetic pump connects the low-pressure reservoir and high-pressure area of the valve actuator. The pump is only a small slit between two electrodes and two pole pieces. The electrodes are supplied by a transformer providing current up to 180 amps at 30 to 40 millivolts. The pole pieces set up a magnetic field as supplied by the field coil. With both a current and flux induced in the liquid metal, a flow is induced through the slit. While alternating current reverses itself 120 times a sec, the flux and current also simultaneously reverse themselves so the direction of flow in the pump is always the same.

Electrical components of the new control valve are potted in an epoxy-filled case to provide a more rugged construction. The liquid metal used is a eutectic alloy of sodium and potassium known as NaK.

Primary advantages of the control valve are: extremely quiet operation with only a slight transformer hum when the valve is operating; small size, about one-third that of previous electric valves, and fast response time, claimed to be one-fifth of the operating time of its predecessors. With few moving parts, maintenance is said to be negligible with long service life.

The "Fluid Power" electric control valve is available in two-way models for hot and cold water or steam and in three-way models for hot and cold water only. They are manufactured by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

# WHY USE TWO WHEN ONE WILL DO?

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cable up to 1/4" O.D. (see size numbers above). And AMP makes the tools — hand and automatic — that control the crimp.

COAXICON consists of polarized, concentric male and female shells, made from drawn parts. The inner contacts, assembled in the shells, will attach equally to solid or stranded conductors. Where contact density is important, a miniature COAXICON fulfills the requirement.

COAXICON connectors will match cable impedances in the 50-100 ohm range, at frequencies as high as 150 megacycles. Impedance mis-match, incidentally, is only 1.06 to 1.09, even at 500 megacycles.

Write today for complete product information.

# AMP INCORPORATED

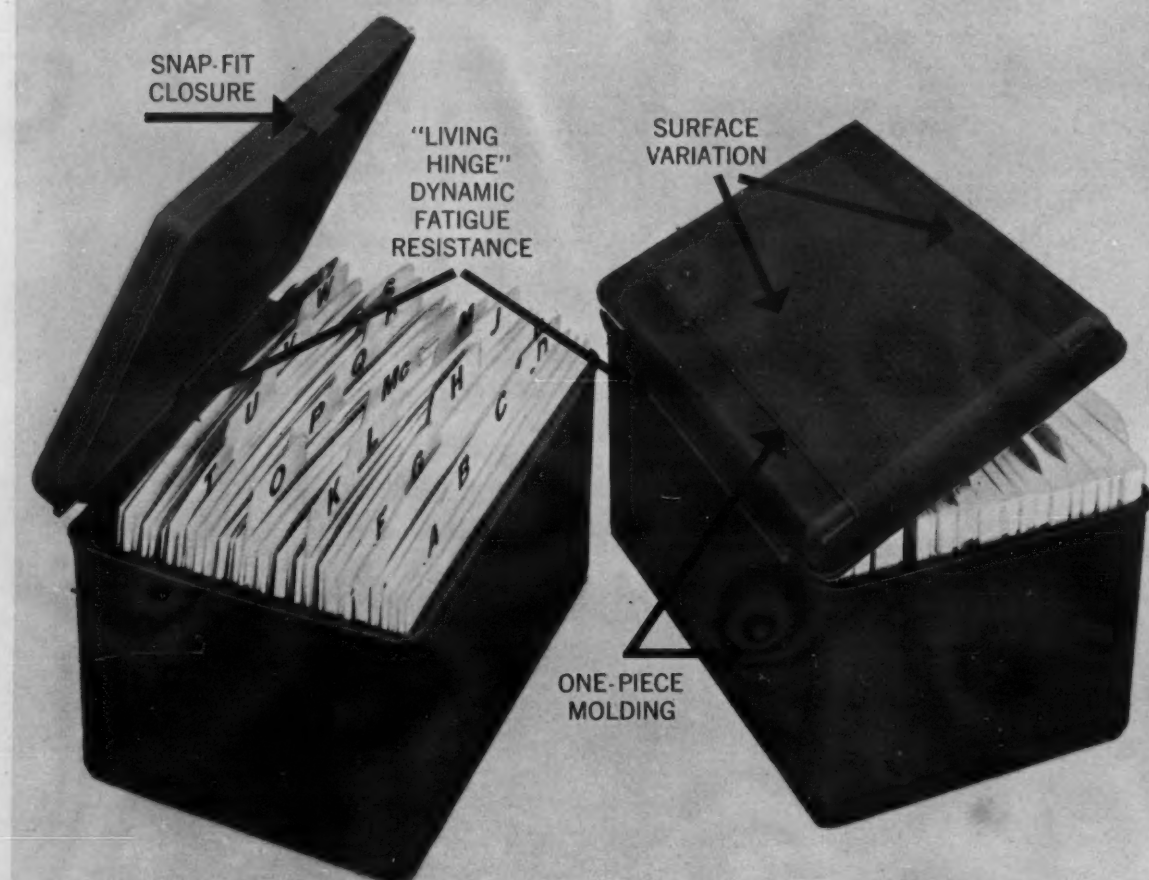
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## WHAT'S NEWS IN PLASTICS



## File box with "living hinge" shows design versatility of Escon<sup>®</sup> polypropylene

A "living hinge" with extraordinary life, snap-fit closures to replace metal parts, various surfaces—gloss, matte or textured—these are just three of the countless design possibilities when you mold with versatile Escon polypropylene. Testing of "living hinges" was discontinued after 1,300,000 flexes without signs of weakening.

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## IDEAS...ELECTRICAL

### Variable-Frequency

Robert L. Candlish, Detroit Editor

**BLOCKING-OSCILLATOR ACTION** is obtained when coupling between base and collector circuit provides large amount of feedback energy. Condensers charge quickly through transistor and discharge slowly through resistance. Little or no collector current can flow while the condenser is discharging. Frequency of operation is determined primarily by time constant of condenser-resistor combination. Resistance is manually variable.

A portable stroboscopic tachometer is triggered by a transistorized, variable-frequency blocking-oscillator circuit. An integral clipper-limiter frequency meter measures the rate of lamp flashing. The oscillator circuit frequency is changed by varying the resistance in the feedback portion of the circuit. The frequency meter automatically measures the cyclic rate as it is changed. Speed is measured by synchronizing the flashing rate with the speed of rotation.

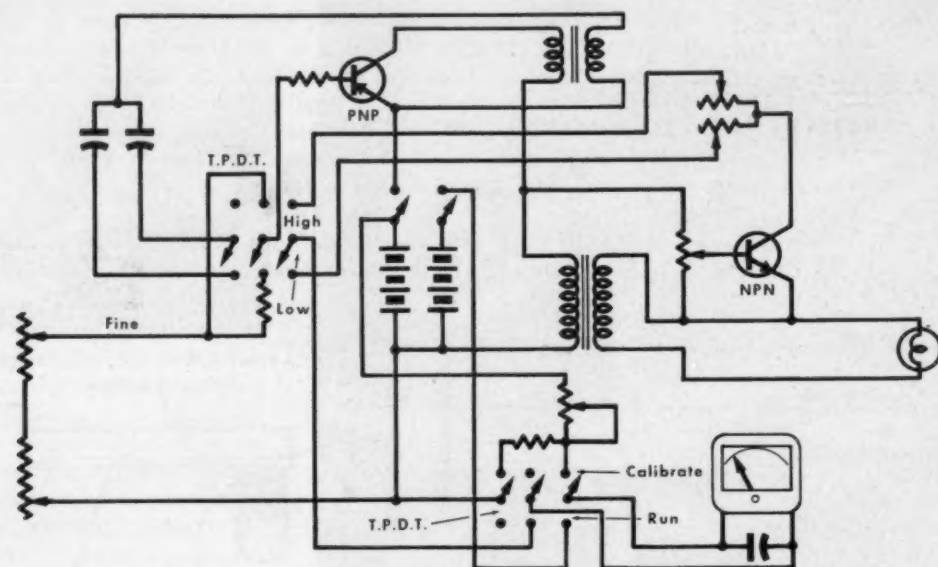
The unit is designed for general-purpose use and is particularly adaptable in measuring speeds of gasoline or diesel engines in motor vehicles. Dual scales on the instrument permit accurate measurement of speeds up to 4000 rpm.

The "Uni-Tac" stroboscopic tachometer is a product development of the Kent-Moore Organization, Warren, Mich.

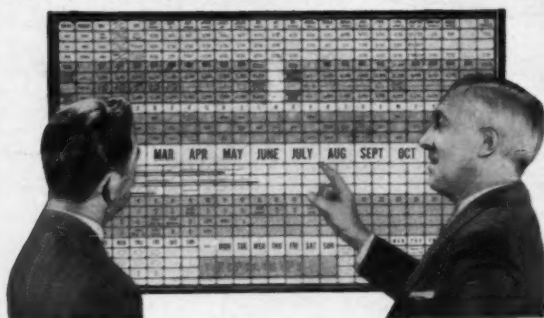


**TRANSISTORIZED STROBOSCOPIC-TYPE TACHOMETER** is self-powered. Flashlight batteries supply current for control circuits. Unit operates either built-in probe-type light powered by integral battery or externally powered high-brilliance automotive-timing light through accessory jack. Calibration of unit is checked by use of accessory synchronous-type clock motor. Unit will retain calibration for several months with little attention.

## Blocking Oscillator Triggers Strobe Light



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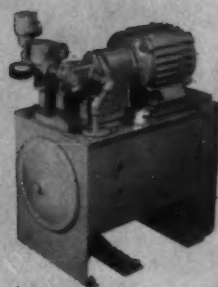
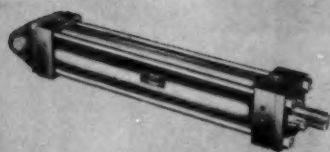
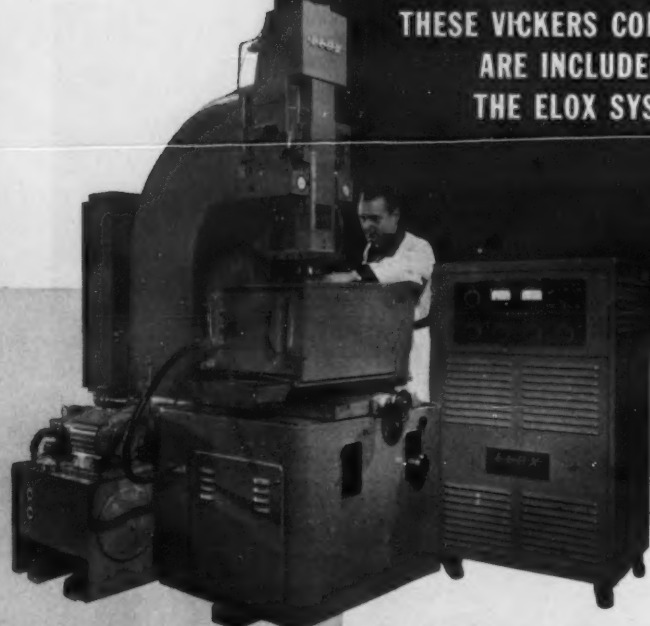


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DESIGN NEWS—MAY 8, 1961



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**HYDRAULIC CYLINDERS**—Low frictional drag and dependable operation of the 3-inch bore, 12-inch stroke cylinders makes them ideal for the Elox machine shown. Vickers builds a complete line of cylinders and offers a wide choice of mounting options, rod end threads, wrench flats, port positions and connections. Standard bore sizes range from 1½" to 8" with either standard or heavy duty rods; special designs can be provided to suit every application. For more details ask for Bulletin 60-68.

**SERVO VALVES**—Extremely critical requirements for low deadband and high response for instantaneous reversals to clear the electrode dictated the selection of a Vickers servo valve for the Elox spark discharge machine. Three series of Vickers servo valves are available to meet every type of industrial application: a single stage valve rated at 0-3 gpm and two series of 2-stage servo valves for flows of 0-17 gpm and 0-37 gpm. For more details ask for Bulletins 59-74, 61-79.

**POWER PACKAGE**—The standard Vickers T-10 power package supplies the steady pressure required for optimum operation of the Elox electrical discharge machine. A vane pump and relief valve matched to the system plus the basic tank unit constitute the power package. Vickers builds the most complete range of power packages available anywhere—all components "matched" in output to insure optimum performance and reliability. For more data on how these power packages can simplify your design and procurement problems, contact your Vickers Application Engineer.

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**IDEAS... ELECTRICAL**

**Sensing Blades Float to Break Electrical Circuits**

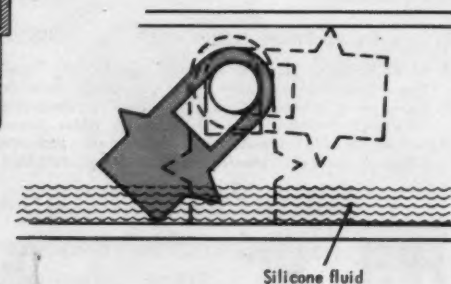
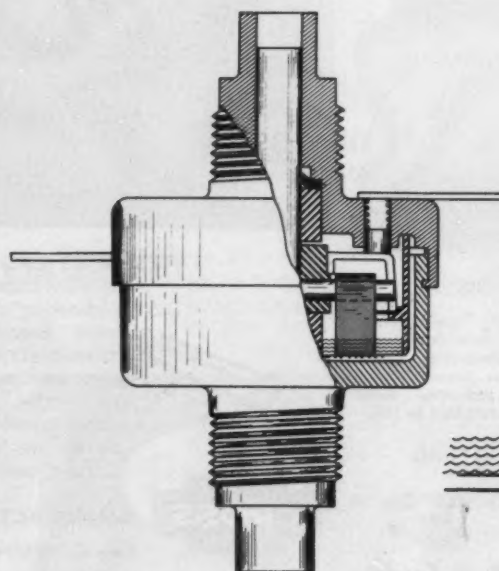
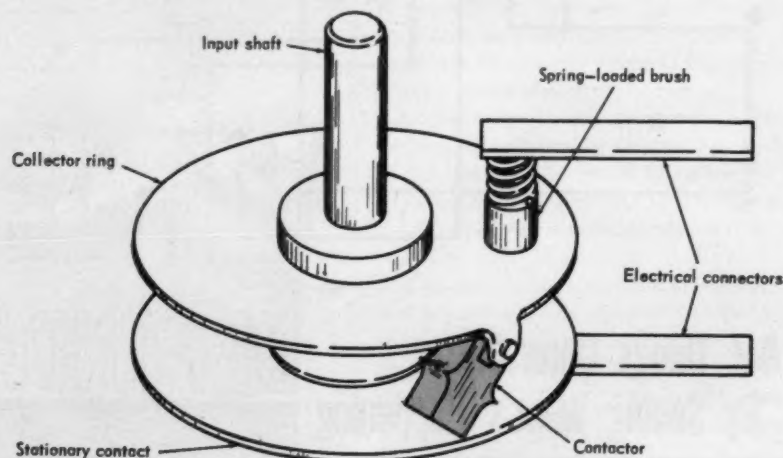
Lars G. Soderholm, Midwest Editor

A simple, low-cost motion detector uses sensing blades that are partially submerged in silicone fluid to sense rotary motion. When idle, the sensing blades rest on a contact plate closing the electrical circuit. The slightest motion causes the blades to plane on the silicone surface and break contact.

Designed to provide accurate sensing (the unit detects rotary speeds as slow

as 2 rpm) and at the same time economical to build, the motion-detector switch is made with a nylon housing. The silicone fluid in which the sensing blades operate permits operation over a wide temperature range from -40F to +240F.

Originally designed to detect "creeping" in automobiles with automatic transmissions, this device is mounted on



Circle 65 on Reader-Service Card

## in Motion Detector



the speedometer drive. When brakes are applied and the automobile comes to a complete stop, the unit triggers a solenoid on the brake-line system which holds a predetermined brake pressure in the brake hydraulic system. When the accelerator pedal is pressed, a second switch releases the solenoid and the car is allowed to move forward again.

Industrially, the motion-detector switch can be used to detect either motion or lack of motion. The manufacturer claims a unit in his laboratories has so far been tested for hundreds of thousands of cycles without wear or failure.

The switch can detect motion in either direction because the blades are slot-mounted and can swing over center. Linear motion can be detected by using a converting mechanism. This unit is about 2½ inches high and weighs approximately 3 oz. The switch is available with grounded shaft as an electrical feed or with insulated shaft and double terminal. Switch is normally closed. However, by using a relay the switch can control a normally open circuit. Voltage and current can also be increased by the use of a relay.

The motion detector switch was developed by the Research Laboratories of Gaylord Products, Inc., Chicago, Ill.



Circle 66 on Reader-Service Card



ROBERT WEBB, RESEARCH DIRECTOR, ELOX CORPORATION SAYS:

**“Jointly developed hydraulic system provides fast response needed for spark machining...”**

“When people have a problem that can be solved with three-dimensional electric discharge machining, they come to Elox for our special skills and knowledge. Similarly, we insure that our machines offer the last word in performance by working as a team with components and systems manufacturers.

“To produce cavity dies like the one shown above, we designed and built a machine with a precision table and a vertical slide accuracy that we can guarantee within .0005” to 12 inches. We were able to develop a hydraulic circuit for the vertical slide and get a faster response than with any other method because Vickers engineers understood our problems thoroughly and cooperated fully in effecting their solution.

“Speed of response is half the story; the other is precise maintenance of the spark gap without ‘hunting’—enabling the spark machining operation to be completed in the shortest possible cycle. Our hydraulic package meets all the foregoing requirements because the indi-

vidual units are matched to each other and to the machine itself.”

The Elox experience is typical of Vickers assistance to machinery builders and/or users in providing outstanding hydraulic equipment or systems to insure peak performance. Specialists working with the broadest line of top quality hydraulic components available anywhere give you a system ideally suited to your specific needs. See facing page for more details about the hydraulic components used by Elox and the entire Vickers line.

**VICKERS®**

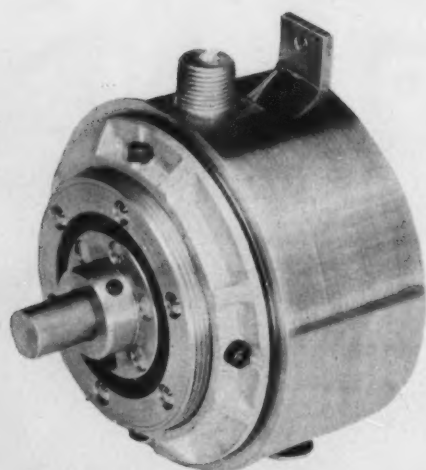
**VICKERS INCORPORATED**

DIVISION OF SPERRY RAND CORPORATION  
Machinery Hydraulics Division  
ADMINISTRATIVE and ENGINEERING CENTER  
Department 1504 • Detroit 32, Michigan



# NEW PRODUCTS

PREVIEW OF PRODUCTS to be shown at the DESIGN ENGINEERING SHOW, Detroit Cobo Hall, May 22-25, 1961. . . A helpful directory for those who plan to attend . . . a useful summary for those who can't attend this year.



## Clutch-Brake Combination

Has Static Torque Rating of 40 Lb-Ft

Booth 1161

When this unit is energized, the coil draws friction face of armature against housing wall for clutch engagement. Torque is then transferred from housing through diaphragm to load-carrying shaft. Wear and potential maintenance are reduced, since armature does not slide against metal shaft when engaging either clutch or brake. Diaphragm pulls armature to center when in de-energized condition. Drive, coupled to clutch, rotates housing while shaft, keyed to armature, is stationary. When energized by current through slip rings, clutch-

coil effects mechanical coupling with armature. Torque from housing then passes via friction coupling through diaphragm to load on shaft. Brake housing applies negative torque to shaft when energized brake coil pulls armature against motionless housing. Standard clutch and brake coil voltages are available in 6, 12 or 24v d-c. Fixed field clutches are obtainable in miniature and small sizes.

Simplatrol Products Corp., 24 Salisbury St., Worcester, Mass.

301

## Revolving Joint

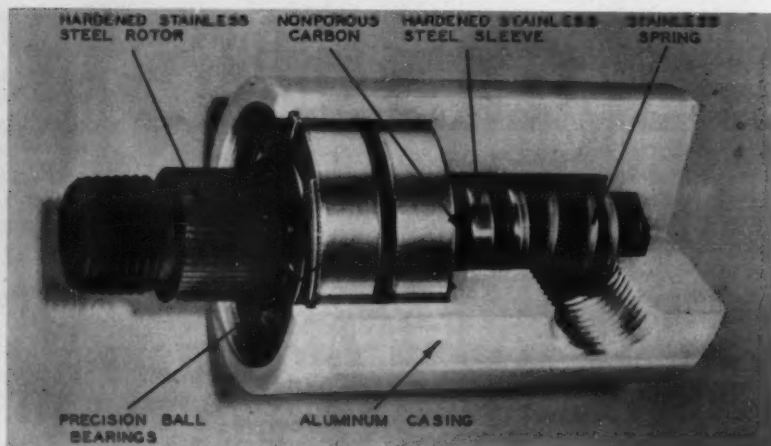
302

Provides Four Rotating Passages

Booth 104

A 1/2-inch revolving joint is capable of handling 500 psi air or hydraulic pressure with a minimum of turning torque at speeds, around 1500 rpm. Long service life is provided by a stainless-steel rotor, case hardened, and a nonporous carbon seat that will align itself to face of rotor. Sleeve on which carbon aligns itself is stainless steel with a "Buna N" O-ring as a stationary seal. Rotation takes place on two precision ball bearings. Entire assembly is seated by a stainless-steel spring and joint casing is made of aluminum. Other styles are available, from 1/4 to 6 inches inclusive.

Rotherm Engineering Co., Inc., 7280 W. Devon Ave., Chicago 31, Ill.

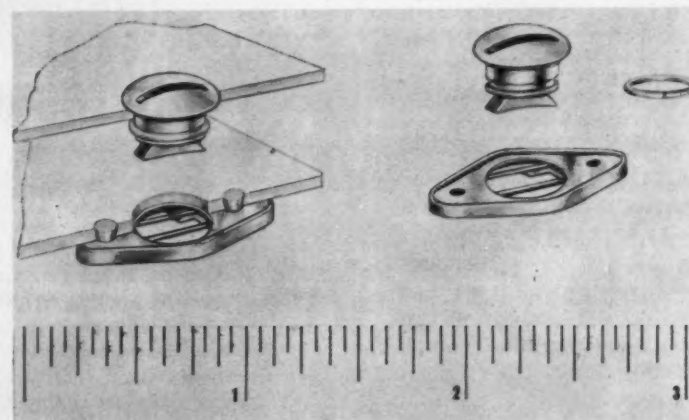


## Quick-Operating Fastener

303

For Space and Weight Limitations

Booth 957



The "Mini-Q-Lock" offers minimum inside projection (less than 1/8 inch) for miniaturized electronics applications, where space and weight limitations are important considerations. The lightweight unit locks instantly with 1/4 turn—unlocks with 1/4 turn. No special holes or tools are required for installation. The quick-operating fastener is constructed of stainless steel.

Simmons Fastener Corp., N. Broadway, Albany 1, N. Y.

## Counter-Bore Fastener

304

Rated 170,000-PSI Tensile

Booth 809



Made of high-strength alloy steel, No. 10 externally-wrenched hex counter-bore fasteners fit in all standard counterbored holes and tighten with standard 3/16-inch thin-wall hex socket wrenches. Body lengths are offered in 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4, 1 1/2, 1 3/4 and 2 inches. Threads are NC (24) or NF (32) Class 3A Fit. Material is alloy steel, double heat treated.

Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, Ohio.

## Reduction Pulleys

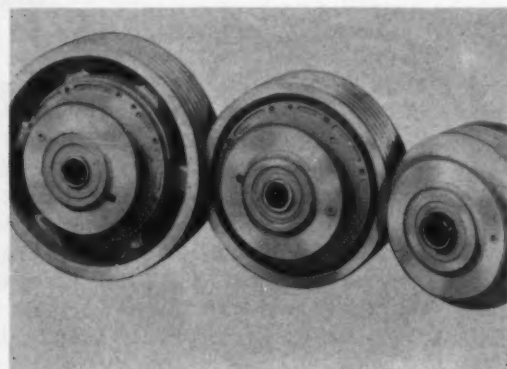
305

Require Minimum Space

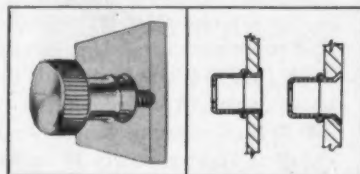
Booth 109

Pulleys for two- and three-speed adaptation include diameters from 10 to 40 inches for internal gear reductions from 1:999 to 1457:1 and for special types up to 8000:1 reductions. Gear reductions are contained in the pulley itself, so that little more space than an ordinary pulley is required. Working model of a two-speed reduction pulley will be on display, showing its operation in several adaptations.

Hart Reduction Pulley Co., 1116 Adam St., Waukesha, Wis.

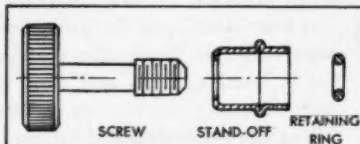


### QUICKLY INSTALLED SOUTHCO CAPTIVE PANEL SCREWS END MISALIGNMENT PROBLEM...



Simplicity of design contributes to clean, distinctive appearance and fast, low-cost installation. Stand-off is slipped into panel hole and secured by flaring. Screw is passed through stand-off and made captive by vinyl o-ring.

"Floating" screw design eliminates costly close tolerance manufacture and permits easy engagement regardless of panel distortion encountered under adverse use conditions.



#### SPECIFICATIONS

**Material:** Screw is brass, chrome plated; can be supplied in stainless steel.  
**O-ring** is vinyl plastic.  
**Overall length of screw:** 1 3/16"  
**Depth of screw head:** 1/4"

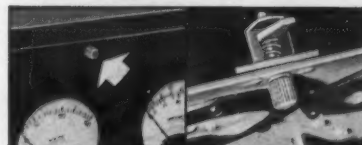
**Sizes:**

SCREW HEAD DIAMETER	THREAD SIZE
3/4"	1/4-20
5/8"	1/4-20, 12-24
3/8"	10-24, 10-32

**Length of thread:** 3/8"

Screw head is supplied plain, as shown, or slotted for screw driver.

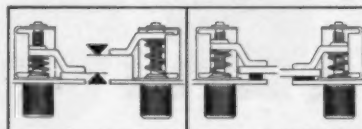
### PRE-ASSEMBLED PAWL ADJUSTS TO DESIRED THICKNESS AND PRESSURE



This neat, compact Southco panel and door fastener is supplied assembled, requires but two rivets or bolts for low cost installation. It is available in three models—large, intermediate and midget.

The unique feature of Southco Pawl Fasteners is the fact that, by merely turning the knob, the pawl is adjusted to a wide range of frame thicknesses. This assures a tight grip without precision setting regardless of variations in frame or door dimensions or changes that are produced by wear or warping of sheets.

Pressure exerted by the pawl on the frame is controlled in the same way, by merely turning the knob. Against gasketed frames, pressure can be easily applied to compress the gasket.



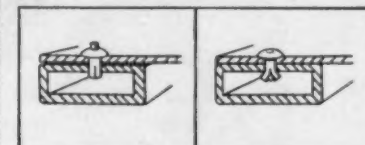
#### SPECIFICATIONS

**Knob:** Cadmium or chromium plated steel.

**Head Styles:** Protruding ribbed or knurled knob; flush screw driver slotted for large size only.

	LARGE	INTERMEDIATE	MIDGET
Knob diameter	3/4"	5/8"	1 1/8"
Total width	2 1/2"	1 3/4"	1 1/8"
Total height	1 3/4"	3/4"	3/4"
Back of panel depth	1 3/4"	1 1/4"	3/4"
Knob length	1 1/4"	1 3/8"	3/2"

### FAST, HAMMER- DRIVEN BLIND RIVETS CUT INSTALLATION TIME



You "hit-the-pin" and the rivet's in. No special tools to limit production or require maintenance, no bucking, no finishing. For blind or open applications, Southco Drive Rivets save time, reduce costs.

Automatic "pull-up" action assures uniform, tight grip.

Southco Rivets are made of aluminum or cadmium plated steel with cadmium plated or stainless steel pins. Diameters are from 1/8" to 1/4", grip range is from 1/16" to 3/8".

Increased widespread use is due to low installed cost and elimination of down time and maintenance associated with fasteners requiring special tools.

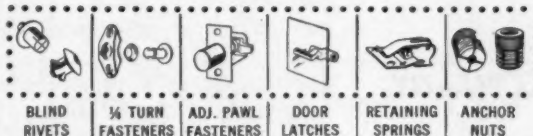
### FREE!

Fastener  
Handbook



Send for your free copy of Handbook No. 9, just released. Gives complete data for designers on these and many other specialty fasteners. 52 pages, in two colors.

Write on your letterhead to Southco Division, South Chester Corporation, 232 Industrial Highway, Lester, Pa.

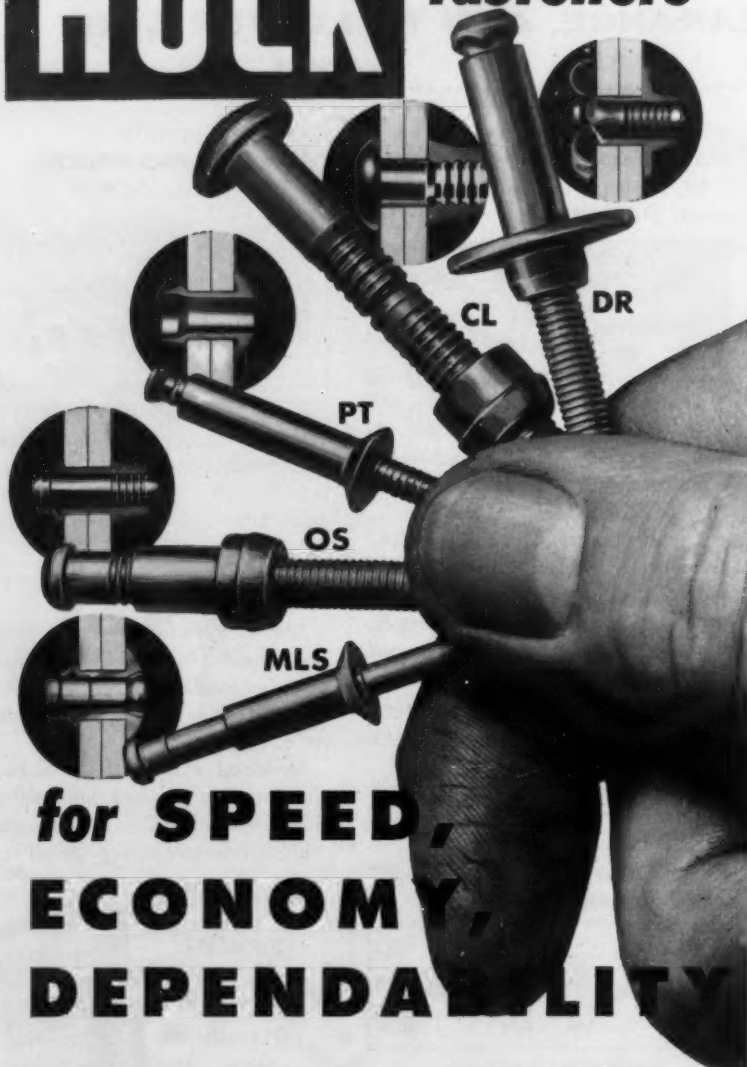


**SOUTHCO FASTENERS**  
LION

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# HUCK fasteners



**for SPEED,  
ECONOMY,  
DEPENDABILITY**

HUCK gives you MORE than "just a fastener". Huck's foolproof installation tools, convenient power units and versatile fasteners give you uniformity and speed of installation beyond your fondest hopes, even with inexperienced operators. Savings of up to seventy per cent on installed cost have been obtained by many users of Huck fasteners.

There is a HUCK fastener to meet your specific requirements whether they be high tensile or shear strength, blind application, thin sheets, wood-to-metal, broad bearing area, flush installation, high clinch, positive mechanical lock, elevated temperature, corrosion resistance or speed of application. A phone call can save you important production dollars. It costs you nothing to find out.

We invite your inquiries.

## HUCK MANUFACTURING COMPANY

2480 Bellevue Avenue • Detroit 7, Michigan • Phone WA 3-4500

Circle 68 on Reader-Service Card for more information

## MECHANICAL

### Clutch-Brakes Booth 1246

Five new products provide increased versatility in electric motion control for various types of machinery. The SF 500 clutch is a nominal five inches in dia, incorporates a ball-bearing mounted field and has a torque rating of 50 lb-ft. A new fhp clutch-brake package is available in torque ratings of 8, 60 and 240 lb-in. A 1350-lb-ft clutch extends torque capacity beyond the present top rating of 700 lb-ft. A stationary field version, this clutch is approximately 15 inches in dia and is physically interchangeable with the present SF 1525 clutch. Offered with a spline drive armature, the unit is used with a special control. Also featured is a line of extended armature hubs for fhp clutches, making the units readily adapt-

able to through-shaft applications. These hubs enable customer to mount a pulley, gear or sprocket directly to same free-running member that supports armature. Hubs are offered in a wide range of bore sizes. The final featured item is a complete line of splined armature drive components for integral hp clutches and brakes. Available for either coupling or through-shaft mounting, the armature drive is suited to heavy-duty applications. Completing the line are electric brakes and clutches for automotive and industrial use, ranging in torque from 1.5 to 1350 lb-ft and in diameters from 1 to 15 inches.

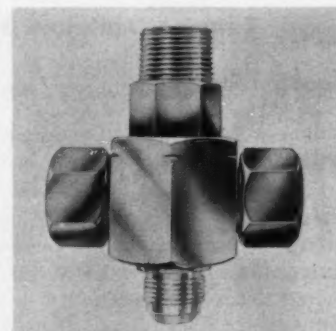
Warner Electric Brake & Clutch Co.,  
Beloit, Wis.

306

### Economical Swivel Connector Booth 956

High-pressure, 360-deg rotation, swivel connector has been developed for pressures to 3000 psi. Design of Series 59 permits equal pressure against all internal surfaces and seals. As internal pressure increases, there is an increase in cushioning effect between swivel shaft and housing. Eight separate sealing parts are said to assure dust-free field service, under adverse conditions. Series may be stacked, used parallel, horizontally, vertically or as a "T". Bend-Tube ends can also be furnished.

Imperial-Eastman Corp., 6300 W. Howard St.,  
Chicago 48, Ill.



307

### Safety Filter Bowl Booth 107

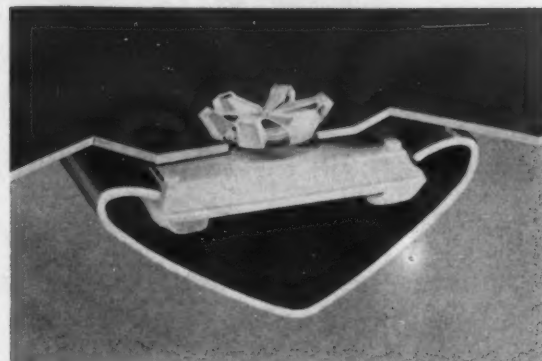
Air filters and lubricators now can be equipped with a "Saf-T-Bowl"—a metal unit with a sight-level indicating gage. This product is proposed as the answer to new restrictions imposed by safety departments on the use of plastic for reservoirs on compressed-air products. The all-metal reservoir is die cast of a zinc alloy and is equipped with a sight-level indicator made of "Pyrex" tubing. The tube is protected from accidental impact by a

thin metal strip running full length in front of indicator. Level of contents is visible a full 230 deg. When installed on an air line, sight gage can be rotated easily to face in any desired direction. The device is impervious to high temperatures, high pressures, steam cleaning, solvents, synthetic compressor oils and high impacts.

Wilkerson Corp., 1649 W. Mansfield,  
Englewood, Colo.

308

### Self-Retaining Fastener Booth 103



This fastener embodies a mechanical locking feature that can be installed easily with a simple hand tool. Of one-piece construction, the plastic fastener speeds assembly and can be installed and locked from one side, making it useful for blind assemblies.

Robin Products Co., 27027 Groesbeck Hwy., Warren, Mich.

### Polyurethane Caster Wheels Booth 1038

The special properties of polyurethane give "Duro/Tred" wheels smoother rolling and swiveling action under heavy loads and over rough floors. Wheels resist abrasion, slippage, most acids, dry heat (up to 250F) and cold (down to -90F). Wheels are offered in diameter sizes of 5, 6, 8, 10 and 12 inches, with load capacities from 800 to 3500 lb each. They will fit both swivel and rigid casters. Other casters available include Se-

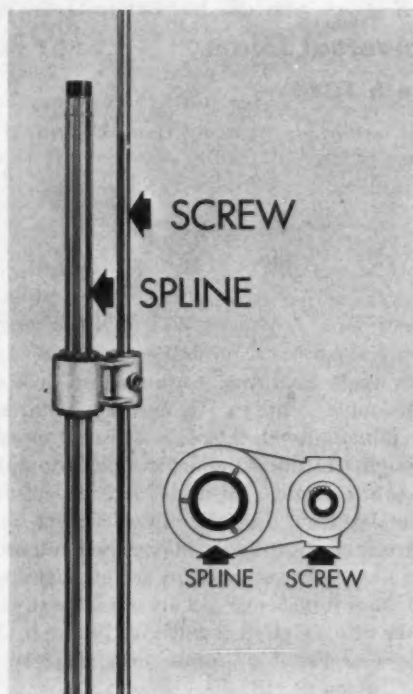
ries L900GS, with neoprene grease seals, designed for use where gritty particles or corrosive chemicals would damage ordinary casters, and Series C2400 medium-duty, swivel-stem casters for mobile equipment, with dual brakes that lock swivel only or swivel and wheel simultaneously.

Faultless Caster Corp., Evansville 7, Ind.

### High-Precision Actuating Mechanism 311 Booth 410

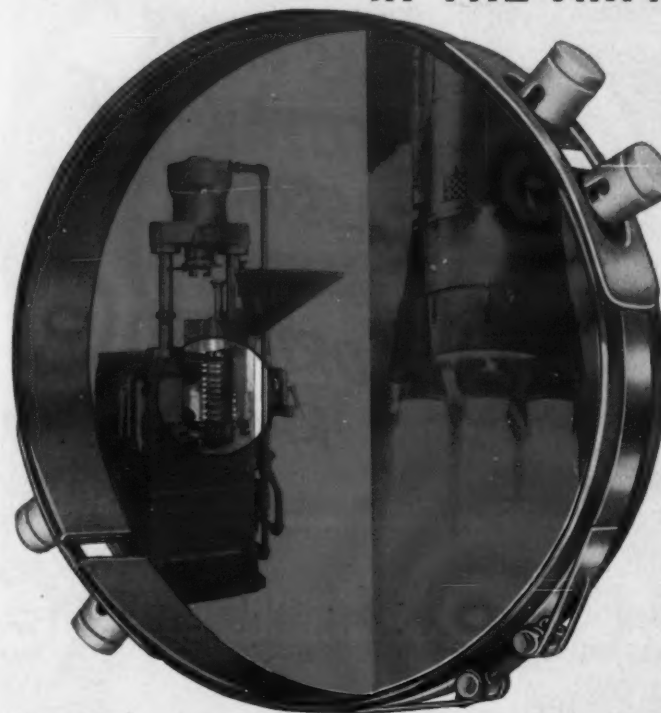
The use of a ball spline in conjunction with a ball screw has been successful in achieving rigidity and performance in a high-precision actuating mechanism without impairing efficiency of ball screw. The particular application involved the use of a 48-inch-long ball screw and demanded the highest possible percentage of efficiency in actuation and sensitivity in positioning control, higher than could be accomplished with a large-diameter screw. Combination ball screw and ball spline can be particularly adaptable in quality machine tools and fixtures where a high degree of efficiency and accuracy is required and where even small inertial resistance, present in a heavy screw, is not acceptable.

Beaver Precision Products, Inc., Clawson, Mich.



309

## ON THE GROUND... IN THE AIR...



## you can rely on WATLOW NARROW-BAND HEATERS!

**ON THE GROUND** — Watlow Narrow-Band Units heat plastic in molding machines. They fit tighter due to the exclusive Watlow clamping band of non-expanding metal — and the tighter fit means better heat transfer. Dependable, long life and fewer burn-outs make Watlow the name to rely on.

Other applications include the heating of stamping dies, or other cylindrical objects.

**IN THE AIR** — A Watlow Narrow-Band heater of special design is launched with the missile. Its job — to keep the gear box on the LOX pump warm and operable when the liquid oxygen, at -200°, is pumped aboard. Only the most dependable heater made can be used in this situation — and WATLOW makes it.

### WHAT'S YOUR HEATING PROBLEM?

New products — new applications often present unique problems in heating. Watlow specializes in custom designed heating units and will help you solve such problems.

**OTHER PRODUCTS:** Firerod Cartridge Units, Standard Cartridge Heaters, Tubular and Immersion Heaters, Strip Heaters, Hot Plates, Thermostats. Write for Watlow Catalog.

• Deliveries two weeks or less.

**WATLOW**  
ELECTRIC MANUFACTURING COMPANY  
1378 Ferguson Avenue / St. Louis 14, Missouri

8104

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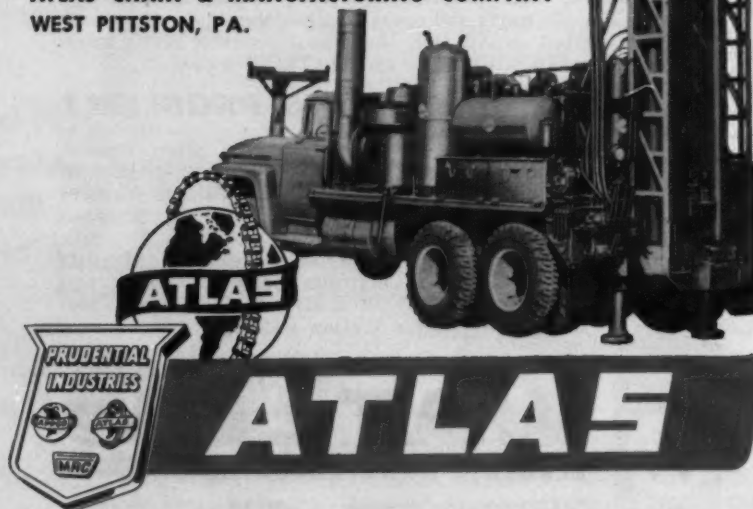
### SCHRAMM ROTADRILLS RELY ON ATLAS ROLLER CHAIN'S HIGH TENSILE STRENGTH AND LONG SERVICE

Atlas Chain No. 140 on hydraulic down pull of Rotadrill furnishes up to 28,000 pounds down pressure to crush through the hardest formations.

Atlas Roller Chain is torture-tested in the laboratory to assure tensile strength far in excess of requirements of actual operations. Extra toughness for shock loads, extra wearability to keep maintenance costs down, extra fatigue life to give long uninterrupted service is built into every length of Atlas Roller Chain.

Whatever the drive where tensile and long life counts you can count on Atlas Roller Chain, Sprockets and Flexible Couplings. Atlas Chain is available in all sizes . . . single or multiple chains . . . regular or heavy duty . . . standard or extended pitch . . . steel, stainless steel, bronze or Atlas Electrolyzed Chain. Write for complete catalog to—

**ATLAS CHAIN & MANUFACTURING COMPANY**  
WEST PITTSBURGH, PA.



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## MECHANICAL

### Spring-Loaded Pulleys Booth 346

312



Variable-pitch pulleys feature a spring-tensioned sliding flange that automatically adjusts to various pitch diameters and holds belt firmly. Pulleys are mounted directly onto motor or driver shaft and coupled by an "A" or "B" belt with a fixed-diameter pulley to form the variable-speed drive. Speed variation is accomplished by varying center distance between two pulleys. Pulley mounts easily onto any standard motor and is designed to work with "A" or "B" belts in drives within the 1/8- to 2-hp range. A special motor base, designed to permit easy and accurate sliding of motor to and away from driven shaft, also can be furnished at small extra charge.

Maurey Mfg. Corp., 2907 S. Wabash Ave., Chicago 16, Ill.

### Universal Joints Booth 1044

313



A line of universal joints for industrial applications up to 1500 rpm is available in both single and double joints in a wide range of sizes. Single joints provide smooth, sensitive operation through a full working angle of 40 deg and double joints through 80 deg. Rated at 0.35 to 190 hp at 100 rpm, they are offered in sizes from 3/8 to 4 inches, with square bore. Case-hardened and fine-alloy steels are used to achieve light weight and durability. Some sizes are available in various grades of stainless steel and with bronze bushings.

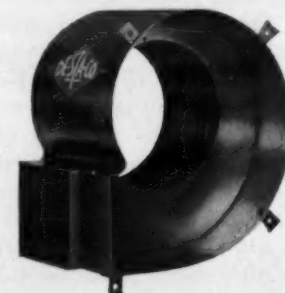
Lovejoy Flexible Coupling Co., 4812 W. Lake St., Chicago 44, Ill.



YOU CAN DO BETTER WITH



PRE-ENGINEERED  
**BLOWER HOUSINGS**  
ASSEMBLIES



We have built into our tooling flexibility which enables us to turn out any quantity of housings—large or small—in a broad range of size and styles . . . Available for wheels 3" to 11" diameter in any width—and we assure you prompt delivery! For your special-purpose housings our engineers will tell you how readily adaptations can be made to save you tooling cost.

Our method of manufacture assures low unit cost—inform yourself . . .

FOR MORE FACTS  
REQUEST  
DETAILS AND BROCHURE  
**YOU CAN  
DEPEND ON DE-STA-CO**



Circle 71 on Reader-Service Card

DESIGN NEWS—MAY 8, 1961

## Straits Tin Report

**Tin reduces wear**—The addition of up to 0.1% tin has a marked effect in eliminating ferrite from the matrix of both gray and nodular irons, producing a wear-resistant fully pearlitic matrix.



Effect of tin on pearlite in microstructure of hypoeutectic cast iron bar, 1.2-in. dia.

The amount of tin added to cast iron sections up to 3 in. thick is not critical. A reasonable excess does not produce any massive cementite or affect mechanical properties.

**Organic compounds** of tin stabilize vinyl chloride polymers to inhibit color at high temperature and to protect against decomposition during processing and degradation in service.

**Low linear contraction** is a property of high tin content die-casting alloys. Tin alloys shrink very little, permitting close tolerances and very thin walls in such typical small castings as pinions, numbering machine wheels, dashpots of electrical instruments, and gas meter grid valves.

### FREE Bulletin

Write today for a free subscription to **TIN NEWS**—a monthly bulletin on tin supply, prices and new uses.

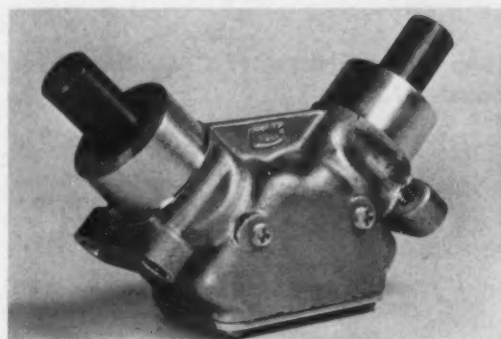


**The Malayan Tin Bureau**  
Dept. T-26-E, 2000 K Street, N.W., Washington 6, D.C.

Circle 72 on Reader-Service Card

## 90-Deg Gear Box

Booth 150



This completely enclosed gear box consists of a cast bronze housing and two spindles with bevel gears supported in needle bearings. The bronze housing has tapped holes for bolting it in place. Gears are splined internally and are pinned for lateral holding only. Gear box is available in three different sizes with torque capacities from 500 to 3500 lb-in and is about 88 percent efficient. Spindle stub shafts are available either keyed or splined in whatever diameter is required to attach to universal joints for reach rod controls or to attach to flexible shafting. Relatively short spindles on gear box mean that box can fit into sharp corners.

Stow Mfg. Co., 43 Shear St., Binghamton, N. Y.

## Booted Universal Joints

Booth 1044

These joints are fitted with oil-resistant neoprene covers which allow them to be prepacked with grease. Cover or boot is held in place by snap wires and can be removed easily or replaced in the field. It does not affect performance of joint, allowing operation through a full 40-deg working angle. The line incorporates both standard and heavy-duty types. Standard-duty joints are available from  $\frac{3}{8}$  to  $2\frac{1}{2}$  inches OD with static torque range from 220 to 30,000 lb-in, horsepower from 0.35 to 120 and speeds to 1500 rpm. Heavy-duty booted joints may be obtained in the same OD's, static torque range from 540 to 48,000 lb-in, horsepower from 0.86 to 230 and speeds to 1750 rpm. Metallurgical construction is case-hardened stainless-steel alloy, with an option of various grades of steel and bronze bushings surrounding pin available for some sizes in both types. Boot OD depends on joint size, ranging from  $1\frac{1}{4}$  to  $5\frac{1}{2}$  inches.

Lovejoy Flexible Coupling Co., 4812 W. Lake St., Chicago 44, Ill.

314

# A POSITIVE SEAL WITH GREAT STABILITY



## Precision "O" Ring Compound 2337



## For Refrigeration Service

**SERVICE**—PRECISION "O" RING Compound 2337—a new development—seals effectively against freon or freon and oil combination in refrigerators and air conditioning units.

**APPLICATION**—For use in couplings, compressors, valves, etc., as either static or dynamic seals.

**CHARACTERISTICS**—Temperature stability, no shrinkage, positive volume increase in freon or freon and oil mixtures assure sealing and extended service life.

Other related new Precision "O" Rings are now giving low cost, trouble-free service in beverage, food and chemical fields.

Sealing reliability for your product is as close as your phone. Our creative engineering service will help you obtain the **right** product design and will assure the **right** "O" Ring for it. Call for the services of a Precision engineer today.

## Precision Rubber Products Corporation • "O" Ring and Dyna-seal Specialist

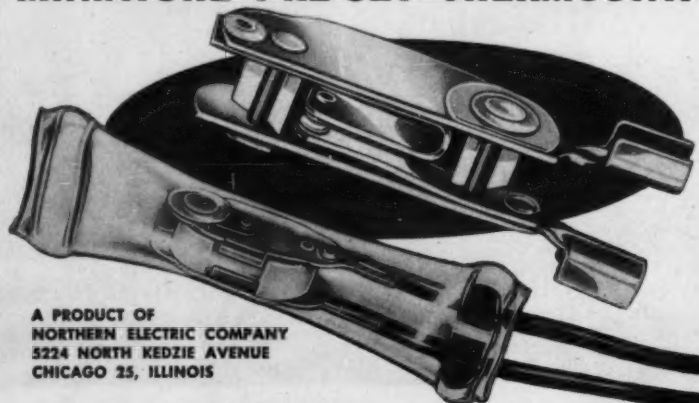
Dept. 6, Oakridge Drive, Dayton 17, Ohio Canadian plant at: Ste. Thérèse de Blainville, Québec  
Circle 73 on Reader-Service Card for more information



# Chace THERMOSTATIC BIMETAL

Actuates Another Precision Product

## Northern Electric MINIATURE PRE-SET THERMOSTAT



A PRODUCT OF  
NORTHERN ELECTRIC COMPANY  
5224 NORTH KEDZIE AVENUE  
CHICAGO 25, ILLINOIS

Utter simplicity is combined with rugged dependability in Northern Electric's miniature ceramic thermostats. These little super-safety devices provide for protection against excessive temperature for refrigeration and freezer defrost heaters; operation of freezer warning systems; and operation of pilot circuits for other appliances where heat is involved.

Depending on the function, these fine Northern Electric products can be provided with contacts which *open* on temperature rise—or contacts which *close* on temperature rise. Since the brass covers are current carrying parts, Northern Electric supplies the unit in moisture-resistant or hermetically sealed (model X-105, above) insulated enclosures with leads. Capacity is four amperes, non-inductive at 115 volts A.C. The current-carrying actuator in this rugged little control is dependable Chace Thermostatic Bimetal.

Manufacturers large and small have come to recognize—and specify—Chace Thermostatic Bimetal because of its dependability. This dependability is born of more than a third of a century of specializing in the manufacture of one product... Chace Thermostatic Bimetal. When you specify Chace, you also receive dependability, uniformity, precision manufacture and economy.

### Send Now For Our New "Information Booklet"!

It contains many well illustrated pages of valuable design data and examples of successful applications of bimetal! More than 40 types of Chace Thermostatic Bimetal are available in coils, strips and completely fabricated elements of your design.

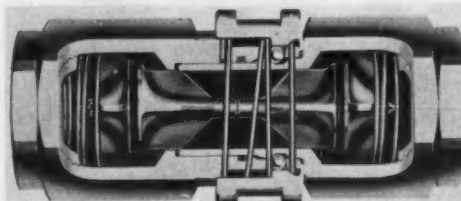


**W. M. CHACE CO.**  
Thermostatic Bimetal  
1612 BEARD AVE., DETROIT 9, MICH.

Circle 74 on Reader-Service Card for more information

## MECHANICAL

### Two-Way Shut-Off Coupling 316 Booth 512



When the Series 12-HK shut-off coupling is disconnected, identical guided valves in both socket and plug contact valve seats to provide instant shut-off of gas or liquid. To eliminate the nuisance of leakage or spillage during its disconnection, coupling is so designed that this shut-off takes place during the brief instant before plug completely separates from socket, and before seal of socket itself, provided by O-ring, is broken. In reverse, when coupling is connected, socket O-ring completely seals coupling before valves release flow of fluid from both sides of line, thus eliminating possibility of spurt of gas or liquid during instant of connection. With coupling connected, fluid flows freely through coupling, with positive seal against leakage insured by compression of O-ring socket against inserted outside surface of plug.

Hansen Mfg. Co., 4031 W. 150th St., Cleveland 35, Ohio.

### Flow Control Valve Booth 549

317

High accuracy and repeatability are features of this unit. The device provides a convenient electrical means of selecting any one of a number of feed rates. This permits programming by automatic control or feed selection in a sequence determined by limit switches. Valve will be available with either of two flow ranges: 0 to 250 in<sup>3</sup>/min or 50 to 1000 in<sup>3</sup>/min. Power input required is a low 3w. Spool is positioned by a torque motor similar to that used in a servo valve. Repeatability of flow settings can be obtained with less than one percent accuracy. The compact unit is pressure-compensated to provide dependable feed rates regardless of work load variation.

Vickers, Inc., Div. of Sperry-Rand Corp., Detroit 32, Mich.



## PRE-VALUE ANALYZED

*for your product*



Hartford's Vers-O-Line is constantly expanding to meet the demand of value analysts for one economical unit to replace several more costly integral parts. Instead of specifying more costly precision bearings explore the possibilities of Vers-O-Line. Hartford engineers can help your design engineers by recommending or adapting a bearing from a wide variety available in stock or can imagineer a new design to meet your product specification that can be produced to effect substantial savings.

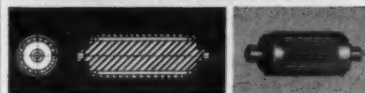
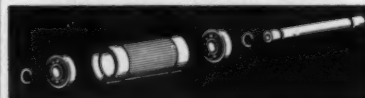


Hartford's Vers-O-Line bearings include:



**RADIAL**... H-Series  
**RADIAL**... Conrad Loaded  
**RADIAL**... Full Complement  
**THRUST**  
**VERSA-TWIN**... Twin Row

**BEFORE**—Six separate parts, expensive bearings and costly to assemble.



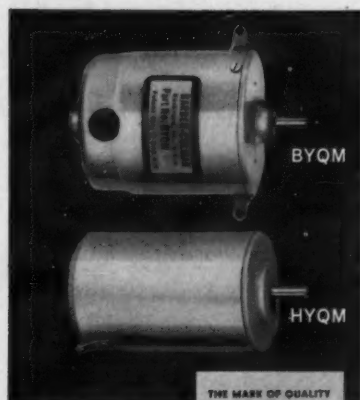
**AFTER**—One complete economical assembly, reduced parts, maximum stability.

Write for comprehensive technical literature containing case history applications and helpful bearing ideas.



**HARTFORD STEEL BALL COMPANY**  
36 Jefferson Ave., West Hartford, Conn.

## Barber-Colman battery-operated d-c motors with integral governors



Ideal for many of  
today's portable  
applications



Type BYQM, top, is inexpensive, yet of excellent quality to meet consumer demand for dependability in mass-produced goods. Type HYQM is an exceptionally fine-quality battery-operated motor for the more demanding applications such as portable dictating equipment.

### BYQM-Typical Specifications

Voltage range.....approx. 3 to 30  
Governed speed.....1200 to 6000 rpm  
Torque.....0 to .20 oz-in.  
Diameter.....1.29"

### HYQM-Typical Specifications

Voltage range.....4.5 to 30 volts  
Governed speed.....1500 to 5000 rpm  
Torque.....0 to .20 oz-in.  
Diameter.....1"

### TYPICAL APPLICATIONS

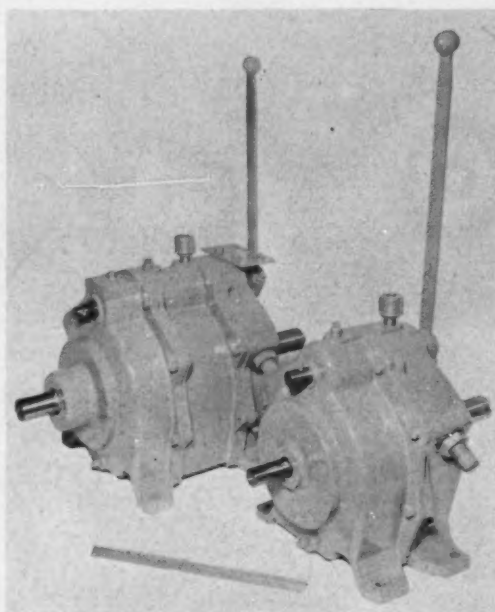
PORTABLE DICTATING MACHINES  
PHOTOGRAPHIC EQUIPMENT  
DRIVE MECHANISMS  
TAPE PLAYERS  
ROTATING BEACONS  
DEPTH FINDERS  
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ROTISSERIES

WRITE FOR HELPFUL DATA SHEETS on  
BYQM and HYQM battery-operated motors  
specifically designed to fit individual cus-  
tomer applications.

BARBER-COLMAN COMPANY  
DEPT. Q, 1810 ROCK STREET, ROCKFORD, ILLINOIS  
Circle 75 on Reader-Service Card

## Reversing Transmissions Booth 1039

318



Planetary in-line-type reversing transmissions have one or two speeds in forward, neutral, reverse and built-in reduction. They are rugged, compact and give smooth performance. Four of the models have maximum input speed of 2400 and limitations of 8 and 28 hp. Single-speed units have reduction in both directions of approximately 3:1. The two-speed transmissions have approximately a 2:1 and 3:1 reduction in the forward and 3:1 in reverse. The 5101 single-speed transmission has a capacity of 8 hp at 3600 rpm with a 2.47:1 reduction in both directions. Series S-N 4000 increasers have input capacities from 2 to 2000 hp at speeds of 1200 to 3600 rpm, developing output speeds in excess of 80,000 rpm.

Snow-Nabstedt Gear Corp., New Haven, Conn.

## Integral Pump and Motor 319 Booth 129

This is a vacuum or pressure pump, capable of producing vacuums to 27 inches Hg or pressures to 15 psi. Model K-5 has a displacement of 12 cfm. Standard accessories include an inlet air filter to keep foreign matter from getting inside of pump, an automatic lubricator which oils pump interior and an outlet oil vapor-silencer. Unit is compact, measuring 22½ inches long by 12 inches wide by 9½ inches high.

Leiman Bros., Inc., P. O. Box 1339, Newark 1, N. J.

# HEYCO NYLON BUSHINGS

## HEYCO STRAIN RELIEF BUSHINGS

for standard and special wires and cables

The Approved Standard for  
Insulating and Anchoring  
ELECTRICAL  
CORDS & CABLES



## HEYCO JUNCTION-TERMINAL BUSHINGS

Miniature insulated receptacle for use with 3/16" quick disconnect terminals. Completely insulated Nylon body.



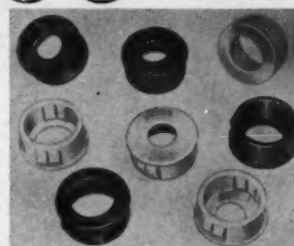
Snap-in Assembly - Color Coded  
Eliminate "Pig-Tail" Wire Leads

### NEW ACCORDIAN TYPE

Adjusts and fits into curved surfaces.  
Available single or connected in units  
from 2 to 5. Color and Number coded.  
Mate with 3/16" or 1/4" female terminals



## HEYCO Snap Bushings



\* Snap locks into panels up to 1/8" thick with  
finger pressure - 35 lb. push back test.  
10 sizes for holes from 3/8" to 1 1/2" dia.  
various inside diameters.

Nylon provides complete electrical in-  
sulation and rugged mechanical pro-  
tection for Electrical wire & cable -  
Tubing & hose-Rope & cable-Bearing  
surface for moving parts.

Same bushings available  
without holes

## FREE SAMPLES!

IT'S EASY TO GET FREE TRIAL SAMPLES OF ALL  
HEYCO BUSHINGS—WHICH ONES WOULD YOU LIKE?

HEYMAN  
MANUFACTURING  
COMPANY

KENILWORTH 5, NEW JERSEY

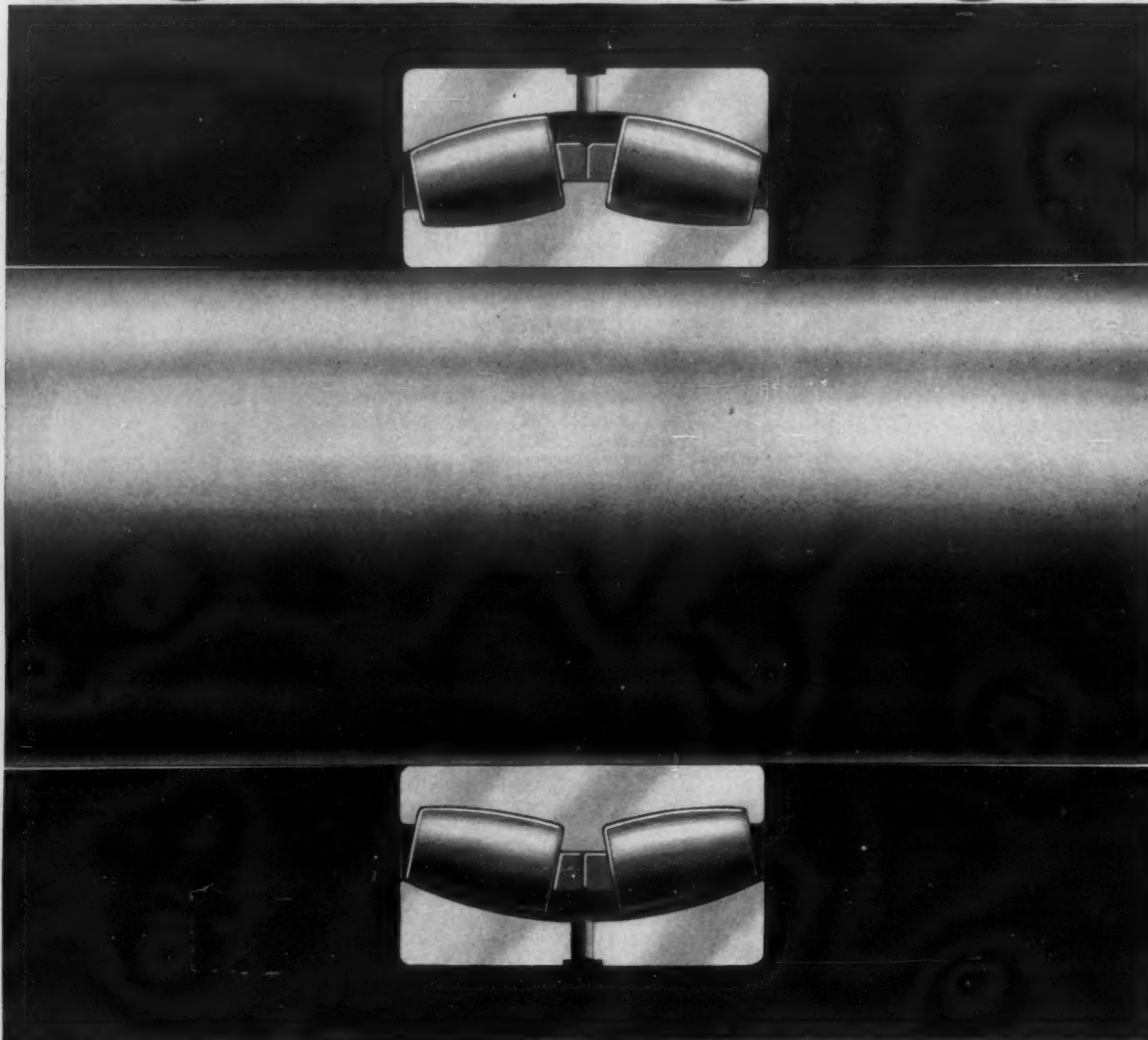


Hey Man... Say HEYMAN!

Circle 76 on Reader-Service Card for more information



# TORRINGTON



## SPHERICAL DESIGN FOR SUPERIOR PERFORMANCE

Full bearing capacity with 3° total misalignment...is an outstanding feature of Torrington Spherical Roller Bearings.

Spherical design compensates *within the bearing* for both static and dynamic misalignment...offers design engineers wide latitude plus considerable savings in production costs.

Result...superior performance, higher radial and thrust-load capacity, longer bearing life.

Torrington Spherical Roller Bearings stand up when other bearings give up. They're backed by Torrington experience in making every basic type of anti-friction bearing. Buy the best...specify Torrington.

### TORRINGTON SPHERICAL ROLLER BEARINGS

offer these features:

- ☐ integral guide flange for roller stability
- ☐ asymmetrical rollers seek flange for positive guidance
- ☐ electronically matched rollers
- ☐ size-stabilized races
- ☐ fully machined land-riding bronze cages
- ☐ controlled internal clearances
- ☐ even load distribution
- ☐ inherent self-alignment
- ☐ long service life

*progress through precision*

**TORRINGTON BEARINGS**

**THE TORRINGTON COMPANY**

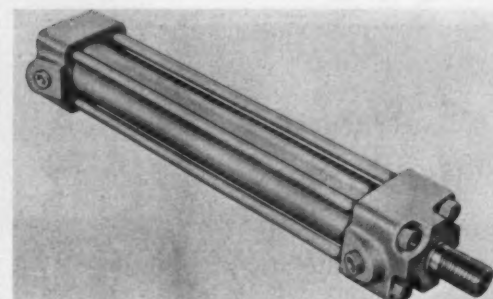
South Bend 21, Indiana • Torrington, Connecticut

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## MECHANICAL

### Double-Acting Cylinders Booth 1203

320



A 10,000-psi hydraulic cylinder is offered in bore sizes of 1½, 2 and 2½ inches, with "push" capacities of 8, 15 and 25 tons. Cylinders are designed primarily as "push" units but with sufficient force to return ram from such work as punching, forming and broaching where spring return is inadequate. Construction features are V-packings, alloy-steel piston rods (10-15 micro finish) and chrome-plated metallic-rod wiper, heat-treated alloy-steel tie rods and nuts and heavy-wall cylinder (10-15 micro finish).

Owatonna Tool Co., Precision Hydraulics Div., 720 Cedar St., Owatonna, Minn.

### Metal Seal Fitting Booth 544

321



This metal sealing ring is useful on straight thread fittings where a conventional synthetic-rubber O-ring with backup washer is not acceptable. This ring is designed to work in standard SAE O-ring fitting boss, providing a metal-to-metal seating for a good seal. Made of type 303 stainless steel, ring answers problems in handling high temperatures and rubber-attacking fluids as well as high pressures. Ring does not have to be replaced with repeated use of fitting.

Parker Fittings & Hose Div., Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio.



Circle 78 on Reader-Service Card



## Have you thought of POLYPROPYLENE for industrial parts?

Montecatini has the know-how to help you produce them! Montecatini developed the first isotactic-polypropylene, MOPLIN, and applied this remarkable thermoplastic to new products for more than three years—longer than anyone else in the field. ■ We have helped customers design with MOPLIN, develop molds, bring polypropylene parts quickly to the production stage. This experience is available to you, as it has been to manufacturers of the advanced components you see here: pumps, impellers, valves, housings, ducts, machine elements. ■ Parts molded of MOPLIN are tough, colorful, light in weight and resistant to heat, impact and chemicals. MOPLIN is low in cost; its molding properties are excellent. ■ MOPLIN is being produced in the United States by Montecatini's subsidiary, Novamont. Technical literature and service are available through Novamont's and Montecatini's representative in the U.S.: **Chemore Corporation**, 2 Broadway, New York 4, N.Y., BO 9-5080.

**\*MOPLIN**  
POLYPROPYLENE

a product of

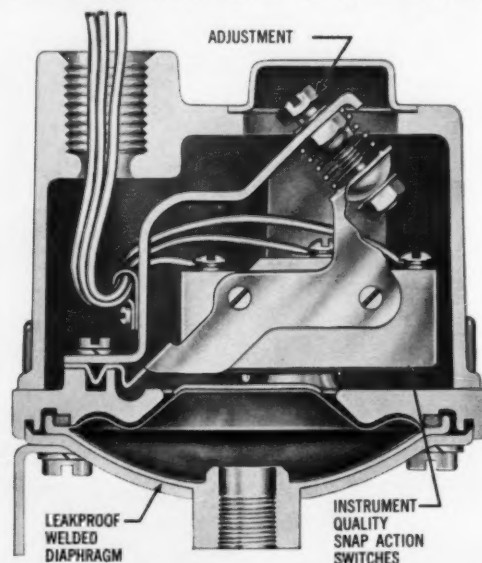
**NOVAMONT**  
**MONTECATINI**

\*Montecatini trademark



## BREAKTHROUGH IN PRESSURE SWITCH ACCURACY at reduced prices

The high accuracy associated with instruments costing several hundred dollars is now obtainable with new Barksdale pressure switches at a retail cost of \$19.00 to \$30.00. Accuracy of  $\pm 0.5\%$  is guaranteed and  $\pm 0.2\%$  accuracy can be supplied when required. Substantial price reduction is accomplished by use of erector set design and a major investment in production tooling. A wide choice of "tailored to the job" features (see column at right) meets your specification requirements exactly.



### THESE POINTS ARE IMPORTANT

#### WE BUILD IN

##### EXTREME ACCURACY and DEPENDABILITY

maintained during operating life due to direct acting design

##### OPERATION IN ANY POSITION

which saves the installation costs encountered in mounting a switch that uses liquid switching elements

##### IMMUNITY TO VIBRATION

you can mount the switch directly on your vibrating or moving equipment.

#### WE DON'T USE

##### LINKAGES & BEARINGS

which, as they wear, make the setting of the pressure switch drift.

##### LIQUID SWITCHING ELEMENTS

which make the switch difficult to mount and very critical to vibration.

##### ACCORDION BELLOWS

which make the pressure switch sensitive to vibration.

PRESSURE SWITCH DIVISION

**barksdale valves**

5125 Alcoa Avenue, Los Angeles 58, California

Circle 79 on Reader-Service Card for more information

### New line of Barksdale pressure switches announced

Improved accuracy, reduced cost and higher proof pressures are advantages made possible by design innovations in the new Barksdale diaphragm pressure switches. Accuracy of  $\pm 0.5\%$  as compared to the customary  $\pm 1.0\%$  is guaranteed, and each unit is tested for repeat accuracy of set point and re-set point before shipment. Accuracies of  $\pm 0.2\%$  are available on request.

### Erector set design offers dual benefit

The basic unit of all Barksdale diaphragm pressure switches is a diaphragm surrounded by a heavy protective capsule to which components may be attached as required. Addition of a switch, switch bracket and adjusting bracket to the basic unit makes a stripped switch for use in a common cabinet with other electrical devices. (Original equipment manufacturers need not pay for a housing which is not needed.) Addition of a sealed housing to the stripped switch completes a weather- and vapor-tight switch unit. A standard housing with integral terminal block or an explosion proof housing with integral terminal block may be specified. Erector set construction allows a wide choice in specifications that approximates a custom made switch and permits use of cost-cutting mass production methods that are reflected in lower prices.

### Proof pressures to 600 psi

In the low settings the new Barksdale pressure switches will actuate at 0.1" mercury with proof pressure to 10 psi. In higher ranges they will go up to 600 psi proof pressure at settings to 400 psi. This makes it possible to use inexpensive diaphragm pressure switches on installations that presently require higher priced bourdon tube switches.

### Important additional advantages

Because the housings of Barksdale pressure switches are independent of the sensing and switching mechanisms changes in ambient temperature will not throw these switches out of adjustment.

The adjustment brackets are specially designed to protect switch terminals against shorting during adjustment.

Lead wires are held down by a tension clip. They cannot be pulled out accidentally and thereby throw off the switch adjustment.

Mounting brackets may be oriented in any of four directions.

Tamper proof adjustment covers have servicing instructions on the inside to allow for painting of the units.

Standard pressure connection is  $\frac{1}{4}$ " n.p.t. female pipe fitting. One-half inch fittings suitable for mounting directly on  $\frac{1}{2}$ " pipe can be supplied on request.

Standard housing has  $\frac{1}{2}$ " nps conduit connections and a terminal block. The latter is accessible without removing the housing by lifting a cover plate.

### Ask for new catalog and handbook

Complete details on Barksdale diaphragm, piston and bourdon tube pressure switches are included in a new catalog and handbook. This free book is a practical aid in planning the vital link between your electric and hydraulic circuits.

It contains a glossary of terms, a schematic demonstration of operating characteristics, and a suggested step-by-step procedure for simplifying pressure switch selection. In addition, the book gives a complete run-down on all the detail features leading to the unit that answers your specific control problems. Send for your copy now, or ask your Barksdale representative.





### Flange-Head Fittings 322 Booth 544

Flange-head ends and bent-tube fittings with 37-deg swivel fasteners include straight connector, 45- and 90-deg elbows as standard items. They are provided for five sizes of two-wire-braid, high-pressure hose, from 3/4 through 2 inches ID and for six sizes of medium-pressure, single-wire-braid cotton-cover hose. The bent-tube swivel-nut fittings—in 45- and 90-deg elbows and a long 90-deg elbow—are available for high-pressure hose from 1/4- through 1-inch ID and for medium-pressure hose from 5/16- through 7/8-inch ID. Swivel nut provides metal-to-metal seating with SAE hydraulic, 37-deg flare cone of hose fitting adapters and tube fittings.

Parker Fittings & Hose Div., Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio.

### Two-Stage Hydraulic Pump 323 Booth 1203

The Model VI hydraulic and oil pumping unit is designed for operating pressures up to 6000 psi. With universal motor, the device delivers 600 cu in/min at 100 psi; 400 cu in/min at 500 psi; 130 cu in/min at 1000 psi, and 90 cu in/min at 6000 psi. When used with the 3400-rpm motor, delivery rate is 600 cu in/min at 100 psi; 400 cu in/min at 500 psi; 135 cu in/min at 1000 psi, and 110 cu in/min at 6000 psi.

Owatonna Tool Co., 720 N. Cedar St., Owatonna, Minn.

# ALLISON eases driver training TORQMATICALLY



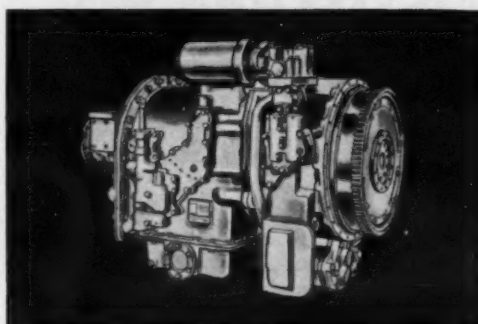
### IN 80-TON COAL HAULERS—

Two of these LeTourneau-Westinghouse TORQMATIC-equipped LW-80 coal haulers replaced five 26-ton trucks at a Kentucky coal mine. "Even in wet weather and with 90-ton loads," the company reports, "the TORQMATIC units get underway slow and easy. A transmission like this that can take up the shock and, at the same time, give us the full benefit of 525 horsepower is bound to cut our maintenance costs to a minimum."



### IN BIG LOGGING TRUCKS—

This Kenworth Model 849 logging truck is big as all outdoors, yet drives about as easy as a small pickup. Reason? Its Series 5000 TORQMATIC Converter-Transmission team takes the guesswork out of shift-work, eliminates the clutch pedal, is so simple to operate that the newest drivers look like "pros" after a day at the wheel.



### IN ANY 450-525 H.P. UNIT—

Newest 5000 Series TORQMATIC DRIVE is the CLBT 5940 designed for Diesels delivering 1,200 ft.-lbs. of torque. It fits large off-highway trucks, scrapers and other high-horsepower, heavy-duty applications, includes a torque converter, hydraulic transmission, lock-up clutch and optional integral TORQMATIC retarder. With 4 forward ranges and 1 reverse, giving 12-phase TORQMATIC operation, it can be direct-engine or remote-mounted with straight-through or transfer case output. Top- or side-mounted power take-offs are also included.—Mail the coupon today for full details.

**Allison** TORQMATIC  
**TORQMATIC® DRIVES**

The world's most complete line of hydraulic drives

Over 980 models used by 108 manufacturers in  
100 to 525 H.P. equipment

Allison Division of General Motors  
Dept. DN-4 Indianapolis, Indiana

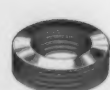
Please send me application data on your  
5000 Series TORQMATIC DRIVES

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_



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Belleville



Compression



Conical



Die



Discs



Drawbar



Energy Cartridge



Extension



Flat



Garter



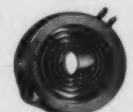
Hairsprings



Helical



Hourglass



Power



Spiral



Starter



Swivel End



Torsion



Variable Pitch



Valve



Volute

# springs

## and other things

custom-made to quality standards

Answer your "where to get it" questions—by calling on the versatile experience represented by these typical springs and stamped parts. Here is unusual ability to analyze your part from both design and production efficiency and to make cost-saving contributions where possible. Whether your requirements are large or small, routine or extreme precision, you'll get a better brand of service and quality from the best springmakers in the business.

Send for "Pocket Guide to Springs and Other Things"—a quick picture of our products and services.



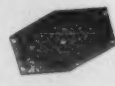
Assemblies



Fasteners



Catches



Plates



Clamps



Retainers



Clips



Stampings



Washers



Electronic Coils



Terminals



Wire Forms



Associated Spring Corporation

General Offices: Bristol, Connecticut

Wallace Barnes Division, Bristol, Conn. and Syracuse, N. Y.

F. N. Manross and Sons Division, Bristol, Conn.

Dunbar Brothers Division, Bristol, Conn.

Wallace Barnes Steel Division, Bristol, Conn.

Canadian Subsidiary: Wallace Barnes Co., Ltd., Hamilton, Ont. and Montreal, Que. Puerto Rican Subsidiary: Associated Spring of Puerto Rico, Inc., Carolina, P.R.

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Ohio Division, Dayton, Ohio

Cleveland Sales Office, Cleveland, Ohio

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B-G-R Division, Plymouth and Ann Arbor, Mich.

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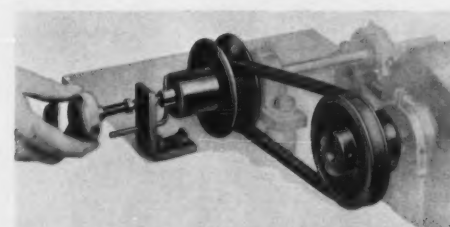
Milwaukee Division, Milwaukee, Wis.

Seaboard Pacific Division, Gardena, Calif.

## MECHANICAL

### Variable-Pitch Pulleys Booth 346

324

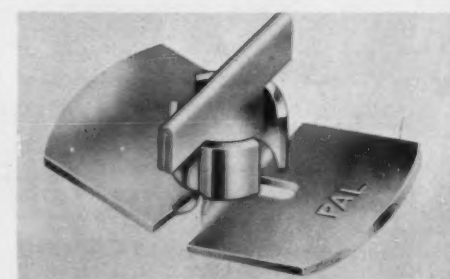


Flexible variable-speed drives, with ratios up to 4:1 in the range of  $\frac{1}{8}$  to 2 hp, use a combination of two variable-pitch pulleys. Connected by either "A" or "B" belts, one pulley is spring loaded, the other is actuated manually. Belt-seating groove of manually operated pulley is widened and narrowed by turning a hand wheel to control operation of drive. Manual actuation produces an instant inverse change in pitch diameter of spring-loaded pulley. Pulleys are offered in a size range of  $3\frac{1}{2}$ -, 4-, 5- and 6-inch OD and can be purchased in combination or individually.

Maurey Mfg. Corp., 2907 S. Wabash Ave., Chicago 16, Ill.

### Quarter-Turn Fastener Booth 115

325

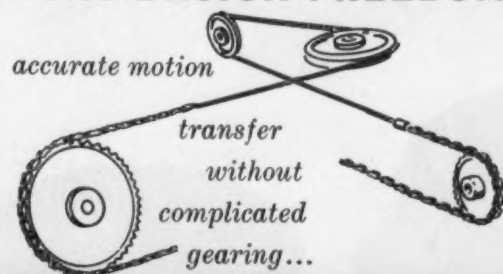


A low-cost, spring-steel fastener is pushed into prepared holes in panels, then quickly assembled by inserting screwdriver into fastener slot, depressing arched head and rotating 90 deg. A barrel shank keeps fastener centered in hole and adds shear resistance. Self-retaining feature keeps fastener in outer panel when assembly is disengaged. Fastener is adapted to many light-duty applications where an economical, quick-access blind fastening is desired. A similar version is also available for finger application.

Palnut Co., Mountainside, N. J.

Circle 81 on Reader-Service Card for more information

## MORE DESIGN FREEDOM



### SIERRA MINIATURE MECHANICAL CHAIN AND SPROCKETS...

Provide precise, positive motion transfer through several planes simultaneously with no cable slippage...no complicated gearing. Unlimited center-to-center selection for miniature and sub-miniature assemblies in servo systems, gyro systems, special cameras, electronic equipment, and small precision instruments. Less weight, cost, maintenance—wider tolerances. Designed to operate around minimum 7-tooth sprocket with root diameter of .250 inches. Chain pitch .1475 inches; Weight .45 oz. per lineal ft. Material: stainless steel, or other materials.

#### NEW CATALOG



Contains useful application data, specifications, tables on chain pitch and sprocket sizes, suggestions for calculating center-to-center distance. Write for yours today.

**Sierra** ENGINEERING COMPANY

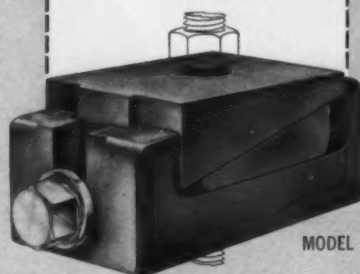
123 East Montecito • Sierra Madre, California

T. M. REG.

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## EMPCO

### VERTICAL-MOTION LEVELING JACKS



MODEL J-H

### AT LAST—A WEDGE-TYPE MACHINE LEVELING JACK THAT LIFTS... BUT DOESN'T SHIFT

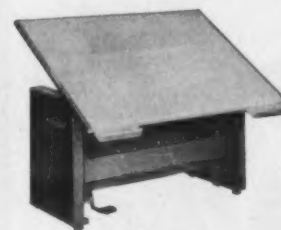
A major advance in precise machine leveling, the new Empco Vertical-Motion Jack gives you the convenience, adjustability and precision of wedge-type leveling—without lateral stress or shifting. Just a simple turn of the hex screw lifts up to 20,000 pounds, easily and precisely—keeps machines performing at their level best! Jack automatically compensates for uneven floors up to five degrees and may be used with anchor bolts where desired.

SEND TODAY FOR BULLETIN 200

Enterprise Machine-Parts Corp., 2729 Jerome Ave., Detroit 12, Mich

Circle 83 on Reader-Service Card for more information

MAYLINE



DESK-O-MATIC

### Two Exceptional Drafting Tables!

The Mayline May-O-Matic and Desk-O-Matic drafting tables have completely counterbalanced top tilting and top height adjustment action. Continued smoothness of operation is thus assured.

These and other Mayline products will be displayed at the convention of Design Engineers, Booth 732, Cobo Hall, Detroit, May 22-25. Visit our booth for an on-the-scene working demonstration.

MAYLINE CO., INC.

529 No. Commerce St.

Sheboygan, Wisconsin



MAY-O-MATIC "E" COMBINATION

MAYLINE

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## WECKESSER



*molded*  
**BLACK NYLON  
SCREWS  
and  
NUTS**

SEE  
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DETROIT

Acid resistant ...  
Need no insulation ...  
Can't rust ...  
Can't corrode ...

#### CUT ASSEMBLY TIME

2-56, 4-40, 6-32, 8-32, 10-32 and 1/4-20 in stock. Actual production samples will give you the whole story. Write on your letterhead.

**WECKESSER COMPANY**

5707 Northwest Hwy. • Chicago 46, Ill.

Circle 85 on Reader-Service Card for more information

## FEL-PRO C5-A

Colloidal Copper Compound

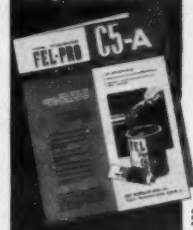
has dozens of uses as a

### Sealant "Protectant" Lubricant

This **PROVEN "Hi-Temp" Compound**, originally designed for use as an anti-seize compound for difficult high temperature application is now being successfully used on such products as:

- valve bodies
- tape recorders
- manifolds
- milling machines
- aircraft and missiles
- jet engines
- pumps
- drills
- heat exchangers, etc.

#### NEW FREE BULLETIN



Wherever an application calls for superior lubrication, high pressure sealing or protection from rust and corrosion, Fel-Pro C5-A colloidal copper compound may be a new low cost answer.

C5-A prevents seizing and galling. Protects stainless steel in high pressure, high temperature applications. It can be used on all metals, alloys and most plastics. You'll find many cost cutting, performance increasing ideas in the Free Bulletin. Send for a copy of the C5-A Bulletin now.

**FELT PRODUCTS MFG. CO.**

7450 North McCormick Blvd., Skokie, Illinois  
Dept. B6, (Chicago suburb)

Circle 86 on Reader-Service Card for more information

## TRIANGLE BEARINGS

with *Engineered* INDIVIDUALITY

Triangle fits the bearing to the application. Whether you can use a standard, like the Pillow Block above, or need a special such as the Pedestal or Clamshell Bearings shown below, your particular bearing problem receives the individual attention best assuring cost reductions—quality improvements.

### SELF-ALIGNING... SELF-LUBRICATING SLEEVE-TYPE PILLOW BLOCKS



The widest selection of mountings available—functionally designed, efficiently produced. Experienced sales engineers available to help you anywhere. Phone or write for descriptive literature.



**TRIANGLE MANUFACTURING Co.**

732 Division St.

Oshkosh, Wisconsin

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## MECHANICAL

### Capped Washer-Base Fastener

326

Booth 115



This spring-tempered steel, integral acorn and washer base nut is offered either with notched locking form for threaded members or with self-threading form for use on unthreaded studs, rods or wire. Assembled fast with standard tools, the unit covers bolt ends and provides resilient tightening and locking action. The device is also available with integral sealer washer to keep out dirt and water.

Palnut Co., Mountainside, N. J.

### In-Line Piston Pumps

327

Booth 549

Designed for a wide range of high-pressure applications requiring low-cost oil-hydraulic power, these units are available in 5- and 10-gpm sizes (at 1800 rpm), with either fixed or variable displacement. They are rated at 1500 psi continuous and 3000 psi intermittent. Pumps operate with minimum temperature rise and low hp loss. Low cost is achieved through use of new materials and advanced fabrication techniques. Hand-wheel, servo and pressure compensator controls are available.

Vickers Inc., Div. of Sperry-Rand Corp., Detroit 32, Mich.



VAX-5.5-LC



VAX-4.5-GR



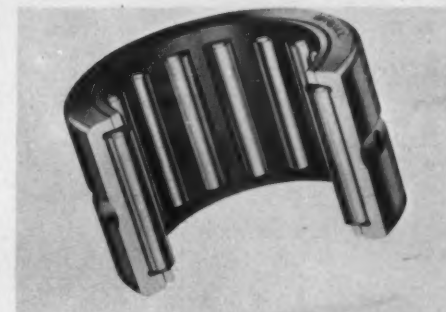
VAX-4.5-LC

**GLOBE**

makes the blower you

## Cage-Type Bearing Booth 1031

328



Interchangeable dimensionally with ordinary heavy-duty needle bearings, this retainer-equipped bearing will provide adequate capacity and deliver high bearing life under adverse shaft misalignment, speed and load conditions. It is available with or without separable inner races. A one-piece, channelled outer race contains a single row of rollers in a continuous steel cage. Outer ring and rollers are through-hardened and precision ground. Black-oxide-finished cages guide crowned rollers in tapered pocket walls.

McGill Mfg. Co., Inc., Bearing Div., Valparaiso, Ind.

## Ferrous Filter Trap Booth 245

329



A combined ferrous trap and filter for installation on lines carrying various liquids or slurries features a magnetic filter screen that removes both iron contamination and nonmagnetic particles in one compact unit. Heart of the trap is a one-inch, stainless-steel, permanent-tube magnet enclosed in a two-inch-dia perforated bronze filter screen with either 0.020- or 0.033-inch dia holes. Magnet and filter are enclosed in a 350-lb pressure bronze casting which has a standard two-inch pipe thread inlet and outlet. Use of connections adapts trap for use on lines of various sizes.

Eriez Mfg. Co., Erie, Pa.



VAX-4-FC

STAX-3-FC

VAX-3

VAX-2

blower	nom. dia.	power	design point
TAX-1-VS	1"	d.c.	10 cfm. @ 0.3" H <sub>2</sub> O not pictured
VAX-2-MM	2"	d.c.	37 cfm. @ 1.5" H <sub>2</sub> O
VAX-2-MC	2"	400 ~ a.c.	50 cfm. @ 2.1" H <sub>2</sub> O
VAX-3-BD	3"	d.c.	80 cfm. @ 1.2" H <sub>2</sub> O
VAX-3-FC	3"	400 ~ a.c.	100 cfm. @ 3.5" H <sub>2</sub> O
VAX-3-GN	3"	115v. a.c./d.c.	70 cfm. @ 1.5" H <sub>2</sub> O
VAX-4-FC	4"	400 ~ a.c.	95 cfm. @ 2.2" H <sub>2</sub> O (140 cfm. @ 2.1" H <sub>2</sub> O)*
VAX-4.5-LC	4.5"	400 ~ a.c.	77 cfm. @ 5.0" H <sub>2</sub> O (140 cfm. @ 5.0" H <sub>2</sub> O)*
VAX-4.5-GR	4.5"	115v. a.c./d.c.	220 cfm. @ 1.8" H <sub>2</sub> O
VAX-5.5-LC	5.5"	400 ~ a.c.	300 cfm. @ 3.0" H <sub>2</sub> O
STAX-3-FC	3"	400 ~ a.c.	30 cfm. @ 14.0" H <sub>2</sub> O

\*at 25,000 feet

### most stocked for 24-hour prototype delivery

For any electronic cooling problem that comes down your road, look to Globe! This big new line of vaneaxial blowers may meet your need right now. Or Globe will design and develop a special blower for your application (it's not as difficult as you think). Because we make all kinds of motors, we can control all the variables—size, weight, high temperature performance, and MIL spec factors.

A.C. blowers are for 60,400 cycle, or variable frequency; a.c./d.c. blowers are for universal operation. Globe also makes a complete line of miniature centrifugal and tube-axial blowers and open fans. Request Bulletin VTC from Globe Industries, Inc., 1784 Stanley Avenue, Dayton 4, Ohio.

## GLOBE INDUSTRIES, INC.

PRECISION MINIATURE A.C. & D.C. MOTORS, ACTUATORS, TIMERS, CLUTCHES, BLOWERS & FANS, MOTORIZED DEVICES

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need!

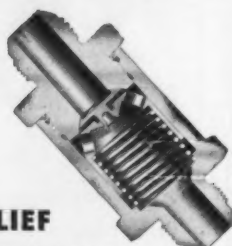


# REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

## CHECK

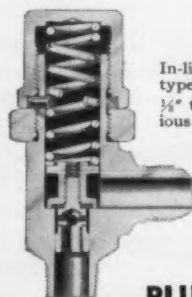
Quality Check Valves of several types—ball, poppet, Hy-pressure, Free-flow—all metals, various portings, and pressures up to 5000 psi. Pipe and tube sizes up to 2".



## RELIEF

In-line and guided piston type Relief Valves. Metal or rubber seal.  $\frac{1}{4}$ " to  $\frac{1}{2}$ " pipe or tube connections. Various metals. Many settings to 2750 psi.

Also Pilot-operated type, with quick unloading and silent operation,  $\frac{1}{4}$ " to 2" to 5000 psi. Remote control pilot available.



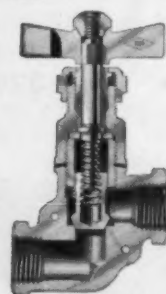
## PLUG

Precision-made Plug Valves for wide general use in brass, aluminum alloy, or stainless steel,  $\frac{1}{4}$ " to 1". +32° to 160°F. With Teflon plug, -65° to 250°F, without lubrication. Aluminum alloy or stainless steel.



## GLOBE AND NEEDLE

Super duty shut-off valves, angle and offset, for up to 5000 psi service,  $\frac{1}{4}$ " to 2", with mounting holes, and panel mounting brackets. Also high pressure Needle Valves for 10,000 psi. working pressure—proofed at 25,000 psi. One piece, stainless steel,  $\frac{1}{4}$ " to  $\frac{1}{2}$ ".



## LO-TORQ SELECTOR

Directional flow control for service up to 6000 psi. Balancing principle uses line pressure to make turning easy with short handle. 2, 3, 4-way, with various drillings. Side, bottom, and sub-plate porting. Panel mounting.  $\frac{1}{4}$ " to 2".

Ask for new catalog, No. 654A, showing entire line.

Distributors in principal cities coast to coast.



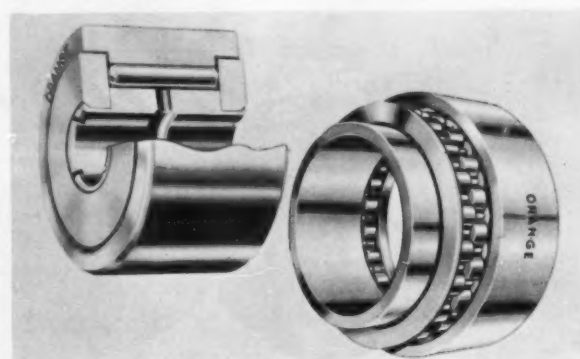
RM

REPUBLIC MANUFACTURING CO.

15655 Brookpark Road, Cleveland 35, Ohio.

## MECHANICAL

### Needle Bearings Booth 1020



A complete line of needle bearings (full type and cage type) includes staggered-roller bearings, journal-roller bearings, cam followers, cam-yoke rollers, thrust-roller bearings and many adaptations of roller bearings for special purposes.

Orange Roller Bearing Co., Inc., Orange, N. J.

330

### Spring-Ejected Panel Fastener Booth 1021

331

An access panel fastener that, when disengaged, automatically pops into fully retracted position provides zero inside projection when unfastened. Chrome-plated screw assembly is retained in an especially designed standoff flanged into door or chassis panel. The unit is of spring-loaded design and is held firmly in full retraction when disengaged, providing clearance for panels to move laterally with respect to one another. The No. 53 retractable screw-fastener assembly is available in stainless steel in seven thread sizes from 8-32 to  $\frac{1}{4}$ -28 and in three head sizes, with or without slots.

South Chester Corp., Southco Div., Lester, Pa.



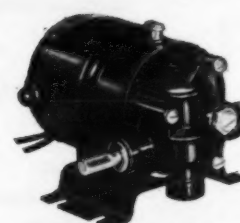
## You Can Find What You Need Quickly...



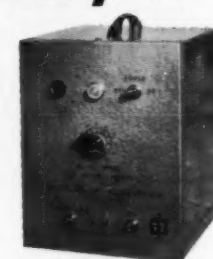
... thru our ready reference stock list file which is now being used daily by thousands of firms all across America. It classifies by groups and according to size the lines we handle, some of which you see illustrated to the right.

All items are listed specifically and full information is given, including: PRICES — Engineering Data — Dimensions — Technical Information — Electrical Specifications ... and all of the many thousands of items listed are ready for IMMEDIATE DELIVERY in single or multiple unit lots.

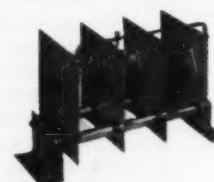
This catalog will save you many hours of time and considerable effort all thru the year ... so if you do not as yet have your copy, send for it today ... there is no obligation.



GEARED & NON-GEARED  
ELECTRIC MOTORS —  
AC, DC, SYNCHRONOUS  
— 1/2000 TO 25 HP —  
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Circle 89 on Reader-Service Card for more information

Circle 90 on Reader-Service Card for more information

## Thrust Bearing 332 Booth 137

The "Nyla-Rol Type NJ" bearing employs a nylon retainer that reduces undesirable sliding friction inherent in most needle thrust bearings. Use of nylon also provides greater life with negligible retainer wear. The inherent qualities of nylon are also present, including low-friction, lightweight, nonmagnetic and noise-dampening features. Needle roller diameters have been standardized at 0.078 inch for the entire line. Bearings can be produced in combinations of bore and outside-diameter sizes.

Kaydon Engineering Corp., Muskegon, Mich.

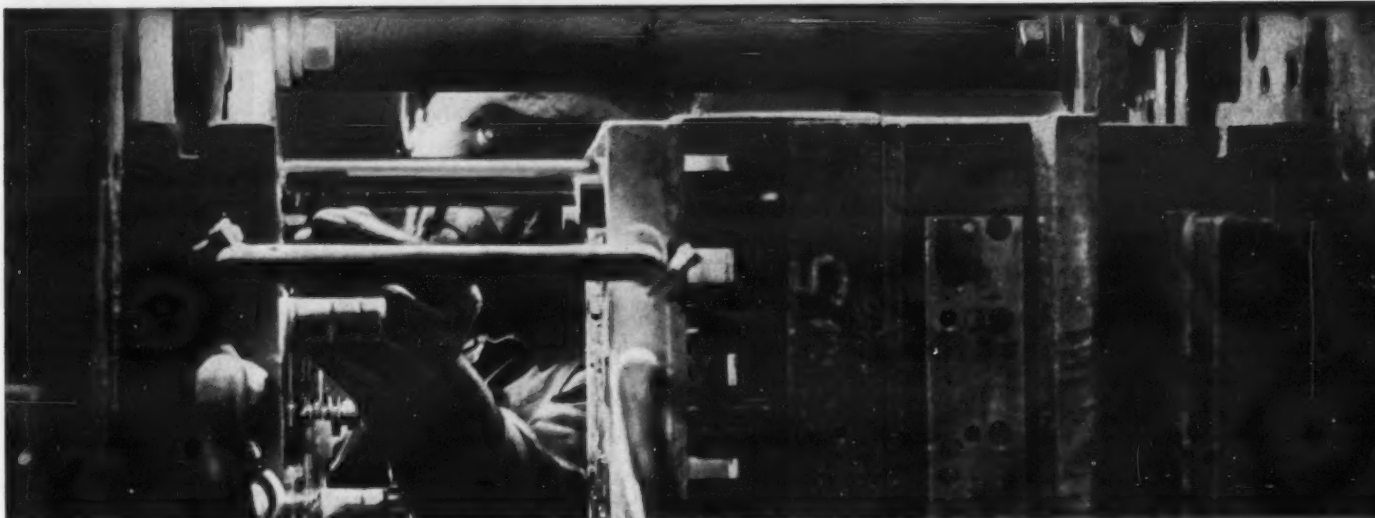
## Variable-Speed Pulleys 333 Booth 1044

Instantly variable ratios up to 3:1 can be obtained with this line of variable-speed pulleys rated at 20 to 25 hp at 1750 rpm, and 10 to 15 hp at 1150 rpm. The pulleys use a No. 27 (2¾-inch) top-width variable-speed belt. They can be used with a number of NEMA frames, including sizes 215, 254, 254U, 256U, 284, 284U, 286U, 324, 324U, 326 and 364. Standard bores are 1¼, 1½, 1⅝ and 1⅞ inches, with a 3¾-inch bore length. Motor travel for full range is 6¾ inches. Maximum pitch dia is 13.1 inches and minimum is 4.35 inches. Overall dimensions are 14¼ inches long by 13⅝ inches OD. Each pulley face is actuated independently by its own spring, assuring equal and simultaneous movement of both halves to maintain constant belt alignment. Pulleys are balanced dynamically to 0.02 oz-in for quiet operation and trouble-free service.

Lovejoy Flexible Coupling Co., 4812 W. Lake St., Chicago, Ill.



Circle 91 on Reader-Service Card



Shell Tellus Oils are refined and formulated to meet exacting hydraulic service requirements, such as in this forming machine.

PHOTO COURTESY ATLANTIC PLASTICS INC., STAMFORD, CONNECTICUT

# BULLETIN:

## Shell provides a quick 6-point check list for hydraulic oils: Use it to pick the right oil for your needs

**Selecting the proper hydraulic fluid for your equipment can be one of your most important decisions. And it can pay off in many ways. Less down time. Lower cost per unit. Longer equipment life.**

**Here are six bench marks to help you pick the best hydraulic oil for your plant requirements.**

- 1. Does it have good oxidation stability?** Oxidized hydraulic oil can form gums, lacquers and other deposits which may foul moving parts. Shell Tellus Oils are carefully refined to remove unstable, sludge-forming components, then fortified with a Shell-developed oxidation inhibitor.
- 2. Will it resist foaming and emulsification?** Pump chatter and erratic operation are often the result of pump cavitation, brought on by oil foaming. Tellus® Oils contain powerful additives to help prevent foaming.

They also contain a selected inhibitor to combat effects of moisture that might be in the system.

- 3. Does it fight rust and corrosion?** It is difficult to exclude all moisture

from a hydraulic system. And moisture can form troublesome rust. Shell Tellus Oils have been carefully compounded to resist corrosion.

- 4. What are its lubrication qualities in continuous service?** Shell Tellus Oils form a clinging, oily film on mating metal surfaces. This maintains a constant guard against wear.

- 5. How does it react to temperature changes?** This is a key factor in the performance of hydraulic equipment. Careful selection of the proper viscosity grade of Tellus assures satisfactory operation of your system over its entire temperature range.

- 6. Is it available in several viscosity grades?** Shell Tellus Oils are available in a broad range of viscosity grades.

There's a special grade for virtually every hydraulic requirement.

Ask your Shell Industrial Products Representative for facts on Tellus Oils. Or write: Shell Oil Co., 50 West 50th St., New York 20, N. Y.

### A message to manufacturers of hydraulic equipment

There is a Shell Tellus Oil suited for your equipment.

- 1.** Your customers can get Tellus Oils at Shell depots everywhere. Readily available throughout the world.

- 2.** Quality is consistently high. Tellus always delivers top performance.



**A BULLETIN FROM SHELL**  
—where 1,997 scientists are working to provide better products for industry

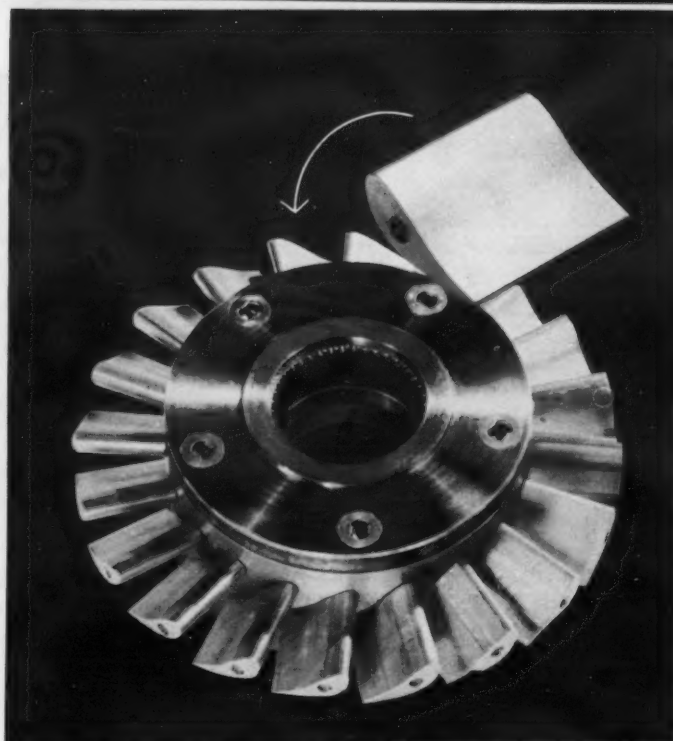


## MECHANICAL

### Compressed Air Dehydrator 334 Booth 107

The "Chem-Guard" dehydrator is made up of standard units, packaged to fit individual needs of a particular application. Rated at a maximum of 10 cfm at 100 psi, the unit will give long service on either intermittent or continuous flows of air. It does not require draining, water or electrical connection. First unit in the package is for removing entrained moisture and small particles of dirt. It is equipped with a built-in automatic drain to keep accumulated contaminants drained off. The second unit is a precision air regulator for controlling pressure. This is followed by an air filter which removes oil fumes, prohibiting them from coating silica-gel desiccant in last unit. This unit is a dryer capable of lowering dew point of air to  $-65^{\circ}\text{F}$ . Dehydrator does not need reactivating. A separate replacement desiccant charge is less costly and is vacuum packed in a sealed can containing exactly the right amount that can be stored indefinitely. Entire desiccant is visible in unit. This package is available as shown or can be purchased with any one of the units omitted. The complete system is useful for installation before paint-spraying operations, pneumatic instruments, air-operated gages (where air is used in glass blowing or making plastic bottles) and other applications where the purest air is required.

Wilkerson Corp., 1649 W. Mansfield, Englewood, Colo.

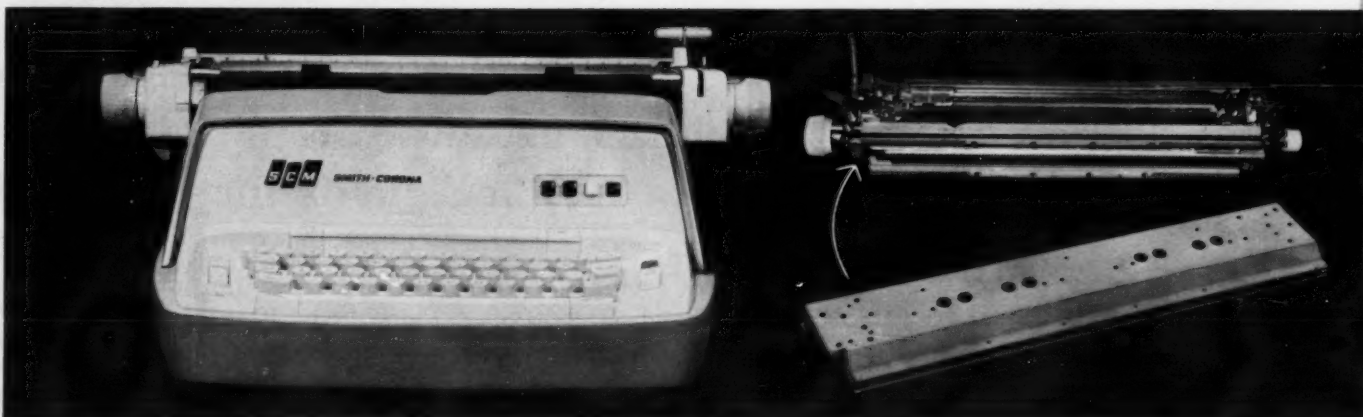


Automotive transmission stator blade

Lightweight precision part for Smith-Corona "400"



Printer's furniture, The Challenge Machinery Company



## ELIMINATE MACHINING, CUT PRODUCTION COSTS WITH MAGNESIUM PRECISION EXTRUSIONS

These close-tolerance parts were produced with no machining costs! They're Dow precision magnesium extrusions which require only end trimming or cutting to length before use . . . and where transverse holes are needed, drilling and tapping. Dow precision magnesium extrusions help manufacturers cut production costs, while providing tolerances as close as  $\pm .001$  inch on critical cross-sectional dimensions, dimensional stability and light weight. There is no machining on the typical parts above . . . component for the ultra-modern Smith-Corona "400" Office Electric Typewriter; The Challenge Machinery Company's printer's furniture; and automotive transmission stator blade. Precision magnesium extrusions can be produced with sharp V's, thin notches, and accurate serrations. Complex parts can be given a consistent precision fit. For information, write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1104AV5-8.



THE DOW METAL PRODUCTS COMPANY  
Division of The Dow Chemical Company



Circle 92 for Reader Service

**DOW**

## NEW DOW MAGNESIUM ALLOY ZE10A

high welded joint strength  
and no stress relief!

New Dow magnesium alloy ZE10A needs no post-welding stress relief. This strong sheet alloy is ideal for fabricating containers, vehicle bodies and other structures . . . and for field repair operations where stress relief can be a real problem.

ZE10A provides very high welded joint strength, important in butt welding of plates. The result—strong, stiff weldments of very light weight . . . with greater capacity, pound-for-pound, than structures made from any other metal!

To weld ZE10A sheet to extrusions, use Dow extrusion alloy ZK21A. No stress relief required. For further information and data, write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1152AV5-8.



ZE10A makes light, strong containers, like this Tote Bin, built by Tote Systems, Inc., Beatrice, Neb., a subsidiary of Hoover Ball and Bearing Company.

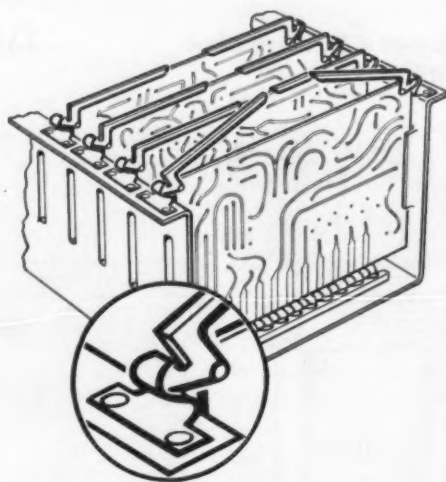
**DOW**

**THE DOW METAL PRODUCTS COMPANY**  
Division of The Dow Chemical Company  
Midland, Michigan

Circle 92 on Reader-Service Card

## Circuit-Board Fastener Booth 1021

335

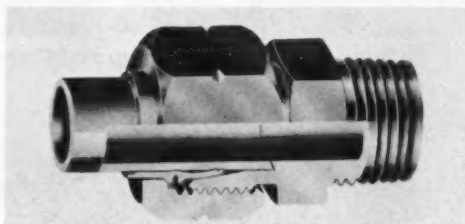


Designed for rapid injection, this fastening device supplies mechanical leverage to set up or break a circuit. A lever which pivots from corner of circuit board engages a spring attached to chassis. Two fasteners are used for each board, so that raising lever arms will automatically eject board from its socket. Lowering arm serves to push board back toward socket, completing circuit and locking board in place. With an 8:1 lever ratio, the fastener enables boards to be replaced in seconds. Spring and lever are SAE 1070 steel, cadmium plated; rivet (for pivot attachment of lever to board) is stainless steel.

South Chester Corp., Southco Div., Lester, Pa.

## Flareless Tube Fitting Booth 953

336



This tube fitting is suitable for use with brass, steel, copper, aluminum, stainless and most plastic tubing. Only three parts including a reversible ferrule with two biting edges make up the component. Nuts are designed to slide around bends, providing ease in assembly and disassembly. Fitting conforms to JIC, ASME, SAE and MIL-F-5506-A specifications.

AFCO Fitting Co., Div. of U. S. Air Compressor Co., 5300 Harvard Ave., Cleveland 5, Ohio.



## Should auld acquaintance be forgot?

Except for depressions, floods and famines, the sales of one of our real old-timers have been booming every year since its introduction in 1944. The whole thing got started when we were requested to build a precision DC relay for floating mines that would surely work after it and the mine had been dropped out of an airplane. We tried, and the relay worked—until the mine went off. After the smoke cleared, and small, long-lived rectifiers and diodes came along, an AC version was hatched. Seventeen years later, it's no surprise (to us, at least) that 34 standard variations have successfully found their way into customers' circuits.

This acme of perfection, reliability and joy to the Management's heart is the Series 5, which is used in either AC or DC circuits to provide: release and operate points very close together; break delay; constant operate voltage despite wide temperature variation; dual coils for differential operation; or meter protection from DC voltage

or current overloads. The "5" can operate on as little as 1 mw., contacts will switch up to 3 amps (depending on sensitivity), and available enclosures range from none to hermetically sealed.

The Series 5 relay is now widely used in burglar alarms, coin-operated arcade games, temperature monitoring controls with Sigma Magnetic Amplifier Relays, boiler water salinity controls, battery chargers and R/C models, as well as in G.I. equipment. The reasons are probably (1) its combination of high sensitivity and stability in hard-knock applications, (2) the "special" characteristics you can get, usually at non-special prices, and (3) the fact that the relay works the way the specs say it does.

\* \* \*

This has been No. 113 in an endless series of messages designed to focus public attention on Sigma's sincere desire to sell relays.

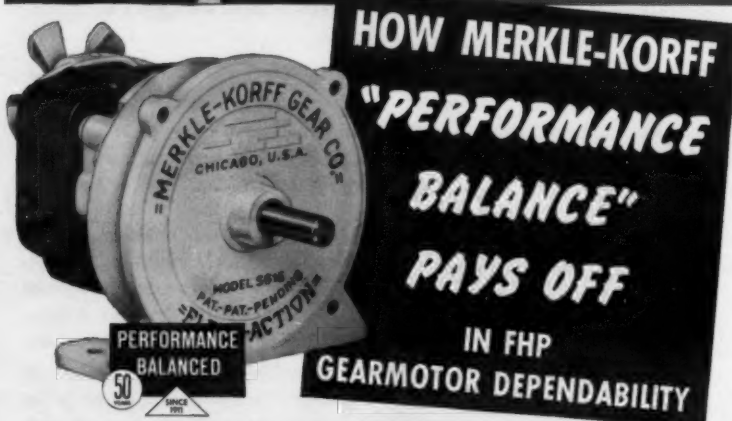
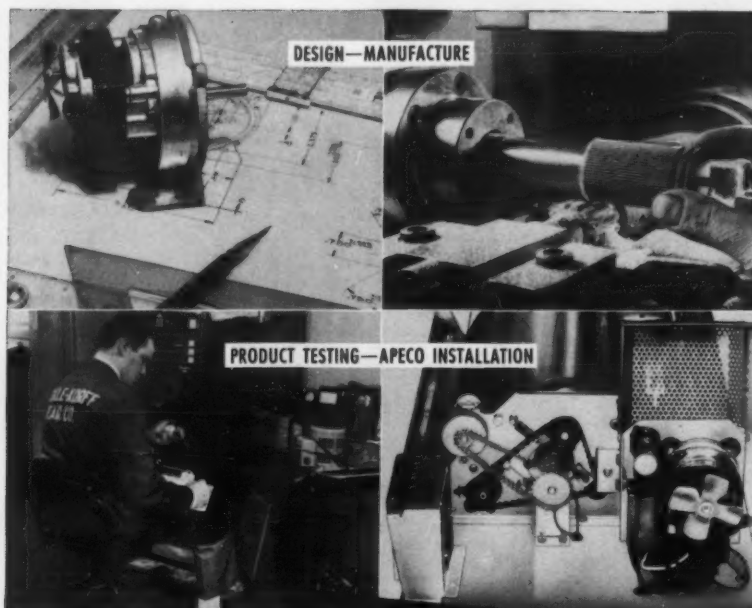
At the DESIGN ENGINEERING SHOW  
Sigma products on display at Booth 211  
May 22-25 Cobo Hall, Detroit

# SIGMA

SIGMA INSTRUMENTS, INC.  
53 Pearl Street, So. Braintree 85, Mass.

Circle 93 on Reader-Service Card for more information





Performance Balance is the perfect mating of Merkle-Korff motor and gearing to your specific application. It prevents money waste and equipment damage through overpowering, and eliminates operating failures due to occasional low voltages and the many hidden hazards of underpowering. Either, or both, the result of "underknowledge" of the drive system by a gearmotor manufacturer.

Merkle-Korff's total understanding based upon 50 years of experience in supplying the right power unit for any given job is available to you. We will, and do, develop and manufacture gearmotors designed to your individual requirements, not only to perform satisfactorily, but to do so at lowest cost. Merkle-Korff service is unique in this respect.

Performance Balance, therefore, is not just a play on words. It is your guarantee of on-the-job performance and dependability. Thousands of cases exist proving the worth of Performance Balancing.

Literature is available. Better still, send us your drawings or product sample so our Applications Engineers can give you a complete evaluation of motor and entire drive system! There is no obligation.



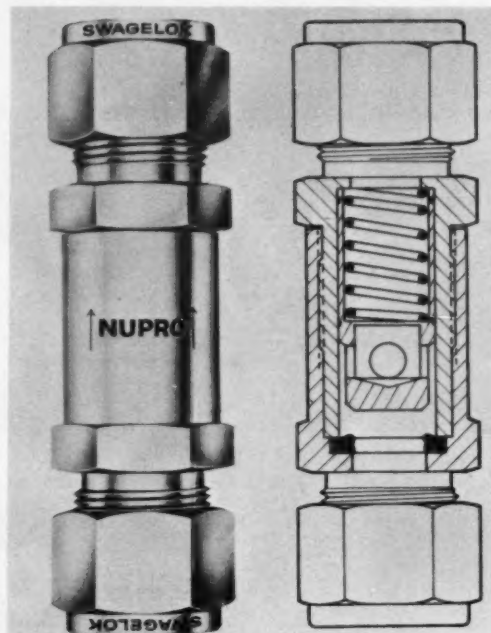
217 NORTH MORGAN STREET • CHICAGO 7, ILLINOIS • MOntro 6-1900

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## MECHANICAL

### Poppet Check Valve Booth 209

337



A check valve in a size range for  $\frac{3}{8}$ ,  $\frac{1}{2}$ - and  $\frac{3}{4}$ -inch tubing is useful in instrument, process and control lines to obtain unidirectional flow. Poppet design provides large flow areas for minimum pressure drop. Turbulence rings are incorporated to provide dynamic stability and rapid shutoff. This action "floats" poppet in body to eliminate sticking and chattering usually caused by metal-to-metal friction. In-line body design is combined with "Swagelok" tube-fitting connections to provide a compact check valve only  $\frac{3}{8}$  inches long and to eliminate the need for additional tube fittings. Valve is available in Type 316 stainless steel and brass.

Nuclear Products Co., 15635 Saranac Rd., Cleveland 10, Ohio.

### Needle-Roller Bearings Booth 1031






338

This bearing line includes cam follower-type bearings; retainer-type needle-roller bearing series and special bearings. "Camrol", "Cagerol", "Guiderol" and "Multirol" bearings will be on display.

McGill Mfg. Co., Inc., Valparaiso, Ind.

## The Story in Back of a Symbol



Begin with a coil  for perceiving electrical changes. Add two arrows  and convert sensing ability  into action. Now, enclose in an ohm  ... and you have the signal  ture of the REGO<sup>TM</sup> family. These controls, of pure simplicity and reliability, are being used in over a million individual applications throughout the world.

Consider one fast-rising scion of the family tree—the REGO<sup>TM</sup> Transducer. If you would like to make a mosquito move a mountain, the transducer will bring you close to the summit. A few grams of force causing less than  $\frac{1}{8}$  inch movement effects direct control at the  $\frac{1}{4}$  kw level.

Performance like this can significantly reduce costs in many control systems: Position, Tension, Weight, Loop, Speed, Pressure and others.

ERC Engineers are ready to assist you with your application. To learn more about the REGO<sup>TM</sup> Transducer, contact:

### ELECTRIC REGULATOR



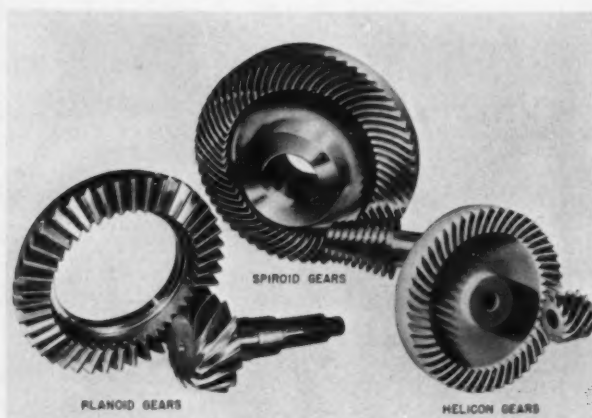
**CORPORATION**  
NORWALK, CONNECTICUT

"leaders in automatic control and regulation"

Circle 95 on Reader-Service Card

## Right-Angle Reduction Gears Booth 844

382



Three basic right-angle reduction gears—spiroid, helicon and planoid—open new design applications to the engineer faced with critical designs and limited space. Combined gear types cover ratios from  $1\frac{1}{2}:1$  to 400:1 in a single set of gears, and in most cases substantial cost savings over conventional right-angle systems are possible.

Illinois Tool Works, Spiroid Div., 2501 N. Keeler Ave., Chicago 39, Ill.

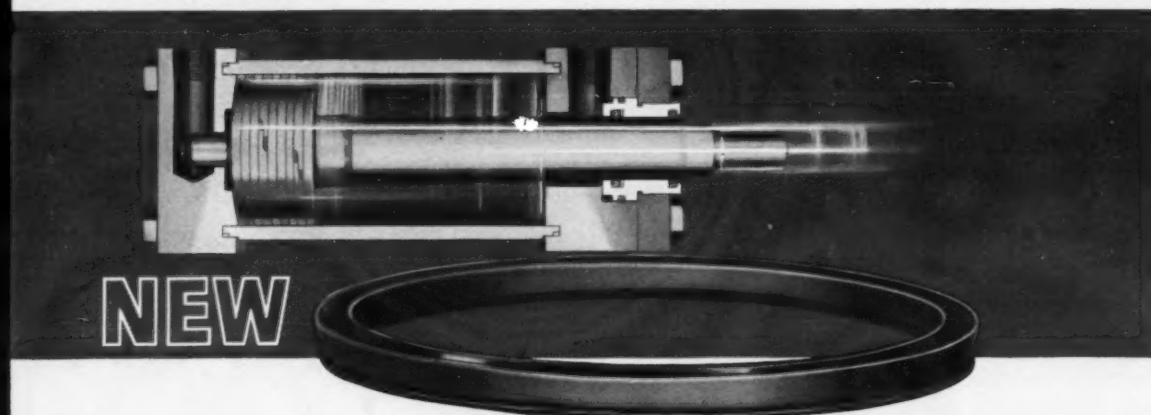
## 200-PSI Valve Booth 1155

383

When this valve is open, supply pressure through inlet port forces an elastic rubber sleeve against the tube, forcing the media to flow around the inlet plug and through outlet port. To close the valve, pilot pressure is applied between inside diameter of the tube and outer periphery of the rubber sleeve. This collapses the sleeve over rounded ends of inlet and outlet end plugs, sealing off supply pressure. Only action is the flexing of the sleeve. Sleeve action automatically controls the flow of air, oil, chemicals and even grinding slurries, without use of poppets or spools. There are no metal-to-metal contacts and no metal-to-rubber seals. This maintenance-free construction makes the valve particularly suitable for the petroleum, chemical and nuclear industries where contaminated fluids and gases present a problem. Pressures up to 200 psi can be handled. Pipe sizes are  $\frac{1}{4}$  to 12 inches. Valve is obtainable either normally open or normally closed.

Airmatic Valve, Inc., 7313 Associate Ave., Cleveland 9, Ohio.

## DURATON ROD SEAL IN HYDRO-LINE CYLINDERS



Here is a new opportunity to reduce machine downtime and costs caused by cylinder leakage or scoring: Hydro-Line's "Duraton" rod seal—exclusive durability formed from

Viton®, guarded by backup washer of carbon-impregnated Teflon.

Leakproof seal is assured by superior resistance of "Duraton" rod seal-backup washer combination to abrasives, corrosives, and pressure. Retains effective resiliency at temperatures to 400°F and higher.

© Registered trademark of E. I. DuPont De Nemours & Company, Inc.

Compatible with virtually all hydraulic fluids. Resists aging.

Iron-oxide-colored "Duraton" rod seals, Ebalon backup washers, and Viton wipers are standard on Hydro-Line Series N2 hydraulic cylinders to 5000 psi. See your Hydro-Line representative for details.

5603 PIKE ROAD, ROCKFORD, ILLINOIS, manufacturers of: high- and low-pressure hydraulic cylinders • heavy-duty air cylinders • boosters • adjustable-stroke cylinders • dispensing cylinders • single-acting cylinders • rod end couplers

Circle 96 on Reader-Service Card for more information

## SPECIAL NUTS

to specs.  $3/8"$  -  $4-1/4"$  cross flats

special machines + large stock of material x years of experience = speedy deliveries high quality low prices



Here are a few samples made to customers specifications . . . Our batteries of special high-speed multi-spindle, automatic machines make possible fast and accurate production of hexagon nuts of non-standard height and special shape from carbon or alloy steel, Naval bronze or other non-ferrous metals; also AN 310 through AN 335 as per latest Airforce specifications. Very often the special nut you require may be similar to one we are already making and a simple modification would result in a price advantage and quicker deliveries to you . . . Send us your blueprint and particulars—let us quote on your requirements . . . We also have a catalog that contains complete specifications, engineering data and prices regarding our standard nuts.

Manufacturer of Standard and Special  
\*12 Pointer, Square and Hexagon Nuts  
... "Huglock" and "Conelock" locknuts.

**NATIONAL MACHINE  
PRODUCTS COMPANY**

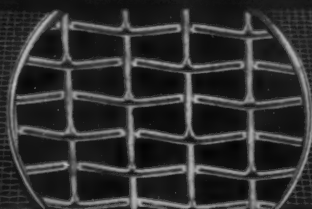
an sps company 44250 UTICA ROAD  
UTICA, MICH

Circle 97 on Reader-Service Card for more information

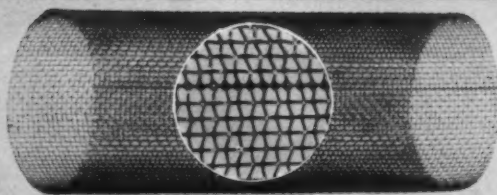


# Need Wire Cloth Specials? Call *Cambridge*

**BRAZED**



**SEAMLESS**



**TEFLON\* COATED**

Right Side Coated

\*Reg. T.M. of DuPont Company



Your Cambridge Field Engineer is listed in the Yellow Pages under "Wire Cloth." Call on him at any time. Or, write for illustrated, 120-page catalog.

These are just 3 of the many wire cloth specialties Cambridge can produce for you—no matter how large or small a quantity you need. Or, if you have an extra-special problem, there's an expert on hand to discuss your special needs . . . your Cambridge Field Engineer. He can show you how to get the results you want—in the quickest possible time at the lowest possible cost.

## If Your Problem Involves Standard Metals or Alloys . . .

we make wire cloth from any metal or alloy that can be drawn into wire . . . in nine basic weaves, and with accurate mesh count and mesh size. Ask about immediate deliveries from our enormous stocks of the most frequently used types of cloth in a wide range of mesh sizes.

Refer to our technical data sheets in **CHEMICAL ENGINEERING CATALOG**, Page 185



## THE CAMBRIDGE WIRE CLOTH CO.

DEPARTMENT D • CAMBRIDGE 5, MARYLAND

Manufacturers of Metal-Mesh Conveyor Belts, Flat Wire Conveyor Belts, Wire Cloth, Wire Cloth Fabrications and Gripper® Metal-Mesh Slings.

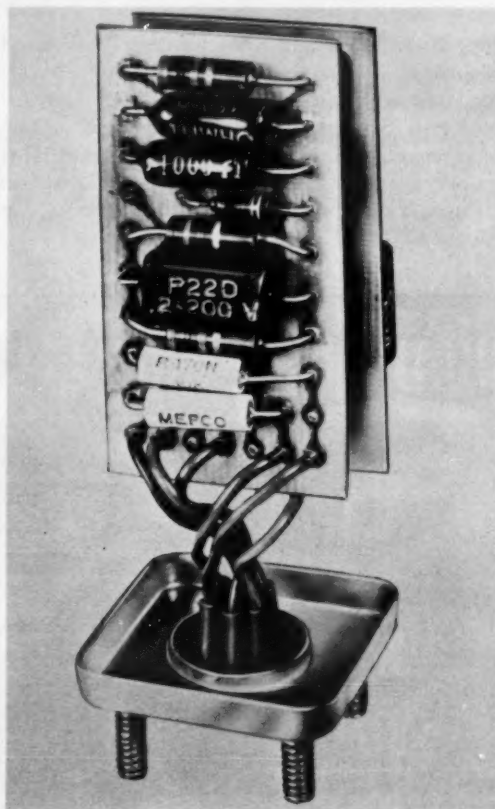
Circle 98 on Reader-Service Card for more information

## ELECTRICAL

### Time-Delay Relay Booth 720

339

Solid-state timing units, designed for 18-32v d-c operation, provide time delay either on pull-in or drop-out, in a total span from 0.01 sec to 10 hr. A selection of standard timing ranges is available in one relay, affording adjustment ratios of 1:1, 20:1, 40:1, 50:1, 100:1, 200:1, 1200:1 or 3000:1. Fixed-time models are offered, in addition to internal or external adjustment types. Printed-circuit panels are used throughout; these are potted and hermetically sealed for maximum environmental stability. Two ambient range designs are



offered: —55 to 70C or —55 to 125C, with fixed-condition accuracies of  $\pm 3$  or  $\pm 5$  percent. All models are protected against polarity reversals, are unaffected by continuously variable input voltage rate and contain integral transient-suppression networks to prevent premature switching. Output may be either solid-state (up to 5 amps) or relay devices (up to 10 amps).

Agastat Timing Instruments, Elastic Stop Nut Corp. of America, Elizabeth, N. J.

**BIG NEWS in high-temperature  
precision-molded insulation**

# **SUPRAMICA® 620 "BB" ceramoplastic**



**NOW!**

What the industry has been waiting for...  
**TRUE HIGH-TEMPERATURE HERMETIC SEALS**  
Helium leakage rate cc/sec. less than  
 $2 \times 10^{-10}$  after severe environmental tests.

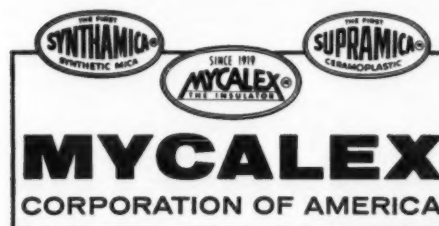
Need a precision-molded insulation material with total dimensional stability under the most adverse thermal cycling, operating to 1200°F... or a material with previously unattainable combination of properties? Check these facts about new SUPRAMICA 620 "BB" ceramoplastic:

- Maximum temperature endurance of material 1200°F. (unstressed). Heat distortion temperature of material 1100°F. (ASTM D648-264 PSI)
- SUPRAMICA 620 "BB" ceramoplastic can be precision molded to most intricate geometries with gauge-like tolerances.
- SUPRAMICA 620 "BB" ceramoplastic will not carbonize.
- Absolute hermetic seals achieved directly during the molding cycle. Components meet a helium leakage rate of less than  $2 \times 10^{-10}$  cc/sec., after the following environmental tests:
  1. Samples heat shocked a total of 20 cycles from boiling water for 30 minutes directly to ice water for 10 minutes.
  2. Samples heat shocked a total of 5 cycles, from 350°C. for 1 hour directly to room temperature for 10 minutes, to -70°C. for 1 hour, to room temperature for 10 minutes.
  3. Samples heated to 500°C. for 4 hours and directly to room temperature.
- Thermal expansion factor matches many metals and alloys.
- New SUPRAMICA 620 "BB" ceramoplastic features a dielectric strength of 270 volts/mil,  $\frac{1}{8}$ " thickness per ASTM D-149.

See this newest advance in the  
*Science of High-Temperature Insulation*  
Visit **BOOTH 1063** at the  
**DESIGN ENGINEERING SHOW**

General Offices and Plant: 140 Clifton Boulevard, Clifton, N. J.  
Executive Offices: 30 Rockefeller Plaza, New York 20, N. Y.

World's largest manufacturer of ceramoplastics, glass-bonded mica and synthetic mica products



Circle 99 on Reader-Service Card for more information



## Tool and Hardware Manufacturers Use Malleable for the Parts They Guarantee...

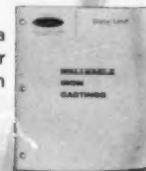
"Guaranteed Against Warping or Breaking" is the seal of quality often found on tools and hardware made of Malleable iron. Frequently Malleable components are guaranteed while the other materials in the same tools are not.

Proven performance superiority has induced many tool and hardware manufacturers to switch to Malleable castings so they, too, can guarantee their products. At the same time, they often reduce their costs. How? Because Malleable provides more strength per dollar than any other metal; Malleable is the most machinable of all ferrous metals of similar properties; Malleable is truly outstanding for its toughness, ductility, castability and corrosion resistance. While Malleable's natural appearance is attractive, a wide variety of finishes can be applied for added customer appeal.

Improve your products by using Malleable castings. Check with any Malleable producer that displays this symbol —



Profitmaking Ideas are yours free in our Data Unit No. 114, available from any member foundry, or Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.



The manufacturer of this unit converted his entire line of machinist vises to Malleable...then guaranteed them against breakage. Not one claim has been made in three years!

For year are saved  
 manufacturer of this  
 back since he con-  
 e 16 inch long  
 to a Malleable  
 he bar originally  
 icated part that  
 earing, punching,  
 ipping, grinding  
 ng, plus welding  
 ints. The Malle-  
 is delivered  
 e at a savings of  
 nit.

When you're interested in high quality and long life, Malleable gives your products many competitive advantages. We'll be glad to show you how. Write or call one of the companies listed below.



# MALLEABLE

## CONNECTICUT

DELAWARE

Eastern Malleable Iron Co., Wilmington 99

## ILLINOIS

Central Fdry. Div., Gen. Motors, Danville  
Chicago Malleable Castings Co., Chicago 43  
Moline Iron Works, Moline  
Moline Malleable Iron Co., St. Charles  
National Malleable and Steel Castings Co., Cicero 50  
Peoria Malleable Castings Co., Peoria 1  
Wagner Castings Company, Decatur

## INDIANA

Albion Malleable Iron Company,  
Muncie Division, Muncie  
Link-Belt Company, Indianapolis 6  
National Mfg. & Steel Castings Co., Indianapolis 22

**IOWA**

Iowa Malleable Iron Co., Fairfield

**MASSACHUSETTS**

**Belcher Malleable Iron Co., Easton**

## MICHIGAN

Albion Malleable Iron Co., Albion  
Auto Specialties Mfg. Co., Saint Joseph  
Cadillac Malleable Iron Co., Cadillac  
Central Fdry. Div., Gen. Motors, Saginaw

## MINNESOTA

**Northern Malleable Iron Co., St. Paul 6**

**MISSISSIPPI**

Mississippi Malleable Iron Co., Meriden, Conn.

## NEW HAMPSHIRE

**Laconia Malleable Iron Co., Laconia**

## NEW YORK

Acme Steel & Mill. Iron Works, Buffalo 7  
Frazer & Jones Company Division  
Eastern Malleable Iron Co., Solvay

Oriskany Malleable Iron Co., Inc., Oriskany  
Westmoreland Malleable Iron Co., Westmoreland

## OHIO

**American Malleable Castings Co., Marion  
Central Fdry. Div., Gen. Motors, Defiance  
Dayton Malleable Iron Co., Ironton Div., Ironton**

Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16  
National Mall. and Steel Castings Co., Cleveland 6

## PENNSYLVANIA

Buck Iron Company, Inc., Philadelphia 22  
Erie Malleable Iron Co., Erie  
Lancaster Malleable Castings Co., Lancaster  
Lehigh Foundries Company, Easton  
Meadville Malleable Iron Co., Meadville  
Pennsylvania Malleable Iron Corp., Lancaster

**TEXAS**

**Texas Foundries, Inc., Lufkin**

## WEST VIRGINIA

West Virginia Mall. Iron Co., Point Pleasant

## WISCONSIN

Belle City Malleable Iron Co., Racine  
Chain Belt Company, Milwaukee 1  
Federal Malleable Company, Inc., West Allis 14  
Kirsh Foundry Inc., Beaver Dam  
Lakeside Malleable Castings Co., Racine  
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

This new line of solderless electrical terminals and connectors covers the larger wire sizes through No. 2 AWG. Elongated ring terminals for tight clearances are featured, as well as regular ring terminals, butt and parallel connectors. All are made in wire ranges of No. 8 (0.050 inch), No. 6 (0.057 inch), No. 4 (0.075 inch) and No. 2 (0.075 inch). Stud sizes from No. 6 through  $\frac{3}{8}$  inch are covered. Units are formed from annealed pure electrolytic tough-pitch copper and are electroplated with pure tin. Samples are available. ETC, Inc., 990 E. 67th St., Cleveland, Ohio.

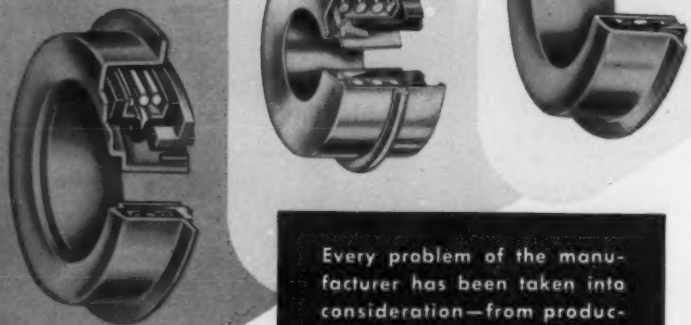
In the WB-16, 16-circuit cycle timer, each switch is mounted individually to permit servicing of any switch without disturbing any other. It can be supplied with extra sets of gears to facilitate changing of timing cycle. Each contact of timer is an SPDT snap-action switch, UL rated at 20 amps at 120, 240 or 480v a-c, noninductive.

Zenith Electric Co., 152 W. Walton St., Chicago 10, Ill.

Circle 100 on Reader-Service Card for more information



## Shaft Seals That Cut Original Equipment Costs



Every problem of the manufacturer has been taken into consideration—from production line requirements to the cost of components in the pricing of the end product.

### THESE ARE SOME OF THE ADVANTAGES YOU CAN PLAN ON WHEN YOU USE JOHN CRANE PRODUCTION SHAFT SEALS:

**ECONOMY**—Low unit cost is achieved through mass production methods.

**FAST, EASY INSTALLATION**—Unit construction permits them to be quickly pressed into position.

**MINIMUM STOCK**—Four sizes,  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ " and  $\frac{3}{4}$ " can be used for all intermediate shaft diameters to  $\frac{3}{4}$ "

**ALL SERVICE CONDITIONS**—Only three types are needed to cover all services . . . water to destructive acids, temperatures from  $-100^{\circ}$  to  $+500^{\circ}$ F. . . pressures to 150 psi.

**RECOMMENDATIONS AND ASSISTANCE**—Tell us about your requirements. We will be glad to give recommendations or provide assistance.

For general information ask for Bulletins S-216 and S-205-3.

Crane Packing Company, 6423 Oakton Street, Morton Grove, Ill. (Chicago Suburb).

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

Visit us at the Design Show . . . Booth No. 237.



Circle 101 on Reader-Service Card for more information

## ELECTRICAL

### Contact Relays Booth 201-

342



Mercury relays consist of up to four single mercury-wetted contact capsules enclosed in a steel vacuum-tube-type housing. Terminals for coil and contact are supplied on a variety of bases as required by user. For printed-circuit work, Type MWB relay is offered in single- or double-contact versions. As a molded-relay module, this permits increased component density through small size. Advantages of mercury-wetted contact relays include: low contact resistance throughout life, which is estimated at billions of operations; absence of pitting or dirt; positive closure; operating speeds of up to 100 operations per sec, and ability to handle loads up to 250 volt-amps, 500v—5 amps maximum.

Adams & Westlake Co., Relay Div., Elkhart, Ind.

### Toggle Switches Booth 1031

343

Designed in basic dimensions with standard operating characteristics, this switch answers applications requiring a double-pole toggle with a 20-amp rating. Electrical ratings are: 20 amps, 125v a-c,  $1\frac{1}{2}$  hp; 20 amps, 250v a-c noninductive; 10 amps, 250v a-c, 2 hp; UL-approved at 10 amps, 125v a-c, "L" rating. Choice of terminals and circuitry makes the switch adaptable to a variety of industrial and consumer products. Terminals are available in spade, screw or solder type. Housing dimensions are 1.237 inches from front to end of spade, 1.2 inches long and 0.762 inch wide.

McGill Mfg. Co., Inc., Valparaiso, Ind.

why, oh why  
should a  
mold or die  
be made  
of  
Speer  
Graphite?

here's  
why

#### IT HOLDS ITS SHAPE.

Does not distort or change dimension regardless of temperature, repeated heating and cooling, or thermal shock.

#### IT WITHSTANDS HIGH PRESSURE.

Speer Graphite has compressive strength of approximately 7,000 psi.

#### IT BECOMES STRONGER WITH INCREASING TEMPERATURE.

#### IT IS CHEMICALLY INERT.

IT IS EASILY MACHINED  
to close dimensional tolerances.

#### IT HAS HIGH THERMAL CONDUCTIVITY.

#### IT IS NOT WETTED BY MOLTEN METALS.

#### IT WILL NOT CRACK OR SPLIT.

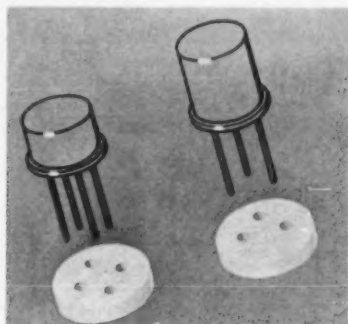
Speer provides molds, dies and many other carbon or graphite parts for high-temperature applications, expertly machined to your own specifications. Call or write for further information.

**SPEER** Carbon Co.  
CARBON PRODUCTS DIVISION  
ST. MARYS, PENNSYLVANIA

Circle 102 on Reader-Service Card

**Transistor  
Heat Sink  
Booth 1134**

**344**



An aid to increased reliability and efficiency of transistorized military and industrial devices is offered with this transistor dielectric heat sink. Used to insulate semiconductor devices from chassis, sink utilizes beryllium oxide's ability to resist flow of electricity but not flow of heat, allowing higher power without exceeding temperature limits. Sinks are available to match JEDEC outlines TO3, 5, 8, 9, 11, 12, 16, 18, 33, 38 and 39, sizes estimated to include more than 75 percent of transistor production. Standard thickness is 1/16 inch. Any other TO size and any custom shape or thickness is available on special order.

National Beryllia Corp., First & Haskell Aves., Haskell, N. J.

**Mechanically Held  
Contactor  
Booth 1237**

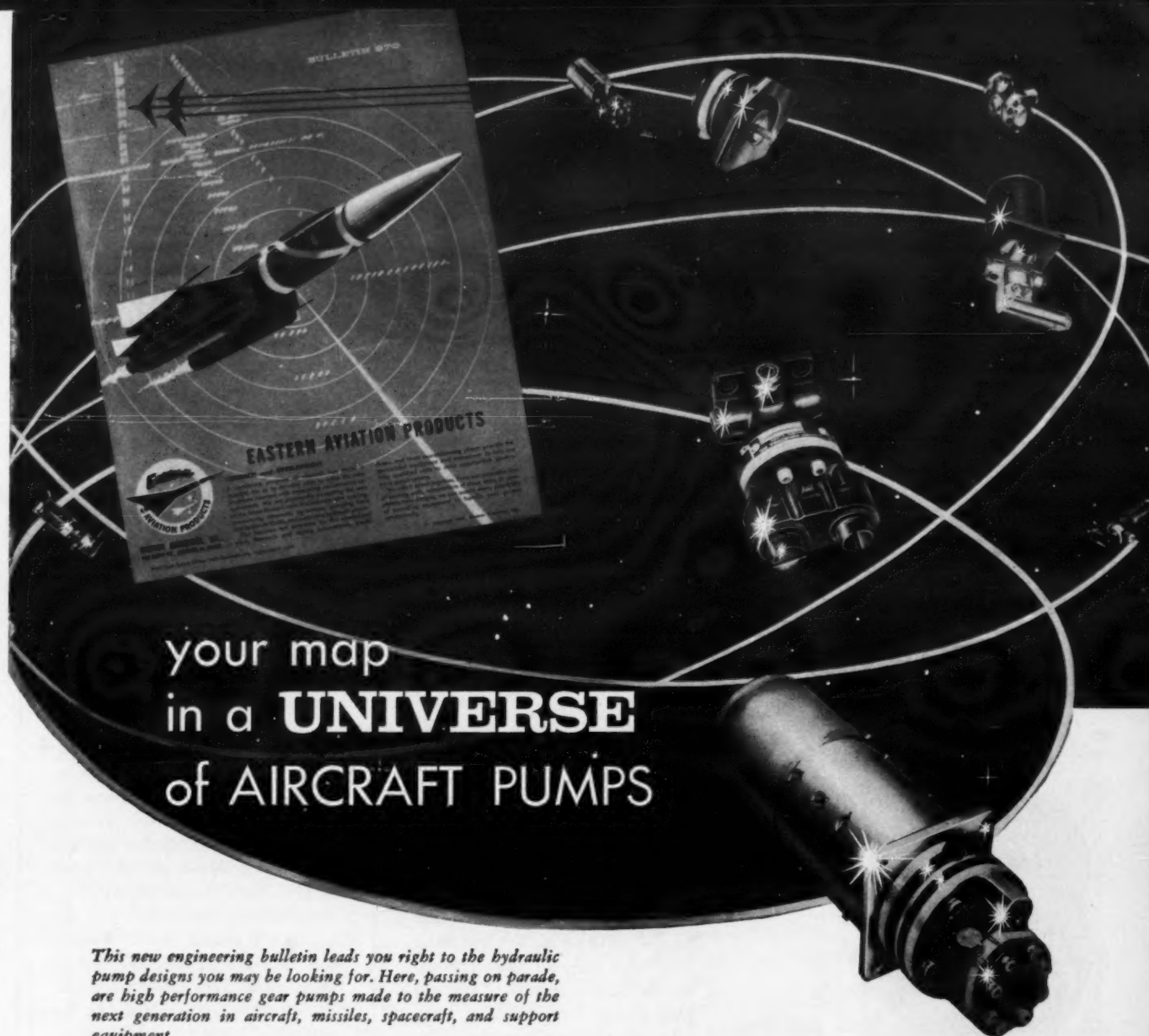
**345**

These contactors are held mechanically, eliminating the inherent a-c hum of electrically held units. A special mechanically held contactor, Model MHP, bus-bar mounted, is featured for switchboard and panelboard applications. Special relay controls also are featured among electrically and mechanically held multipole 20-amp relays.

Zenith Electric Co., 152 W. Walton St., Chicago 10, Ill.



Circle 103 on Reader-Service Card



*This new engineering bulletin leads you right to the hydraulic pump designs you may be looking for. Here, passing on parade, are high performance gear pumps made to the measure of the next generation in aircraft, missiles, spacecraft, and support equipment.*

*Many of these units are the product of ready-made, mass-produced components that can be teamed into the precise configuration you need. Custom-designed pumps are also available.*

All have in common these classic Eastern hydraulic pump characteristics:

**SMALL SIZE:** Eastern gear pumps are the smallest, lightest made. Airborne servo system pump shown delivers 1.5 gpm @ 1500 psig — measures only 1 7/8" x 1 7/8" x 2 3/4", weighs 9 oz.

**WIDE PERFORMANCE RANGE:** pumps available have theoretical displacement from .0016 to 1.30 cu. in. per revolution — flow from .025 to 9.6 gpm, pressures from 0 to 2000 psig, at speeds to 24,000 rpm. Weights with motor range from 1.5 to 8.5 lbs.

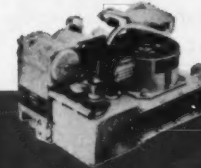
**UNAFFECTED BY EXTREME ENVIRONMENTS:** rugged, reliable Eastern units take loads to 50g in stride — shrug off temperature differentials to meet MIL specs.



**EASTERN  
INDUSTRIES  
INCORPORATED**

100 SKIFF STREET • HAMDEN 14, CONNECTICUT  
WEST COAST OFFICE • 4203 SPENCER ST. • TORRANCE, CALIF.

- Other Eastern products:**
- hydraulic motors
  - servovalves, amplifiers, actuators and systems
  - pressurization/dehydration packs
  - quick-disconnect couplings
  - electronic tube cooling units





## ELECTRICAL

### Low-Pressure Switch

346

Booth 455

The problem of sensing and indicating changes in low pressures has been simplified by this low-pressure device. Designed to handle a maximum set pressure of 7 psi, the unit features a dead-band of only 2 inches of water and repeatable accuracy of  $\pm 0.5$  percent. A "Ni Span C" capsular sensing element is used to reduce any change in the pressure set point by thermal reaction over the operating range of  $-65$  to  $300^\circ\text{F}$ . Weighing approximately 2 oz and occupying



3 cu in of space, switch meets most miniaturization specifications. An SPDT snap-action switch, enclosed in the cylindrical housing, is capable of handling a current of 7 amps at 115/230v a-c. Ports for low-pressure switch are standard  $\frac{1}{4}$  NPT male fittings, but AN fittings are obtainable on request.

Pamar Electronics Co., Inc., Subsidiary of Hoke, Inc., 1 Tenakill Park, Cresskill, N. J.

# IMPORTANT POWER HYDRAULIC PUMP

## QUIET OPERATION



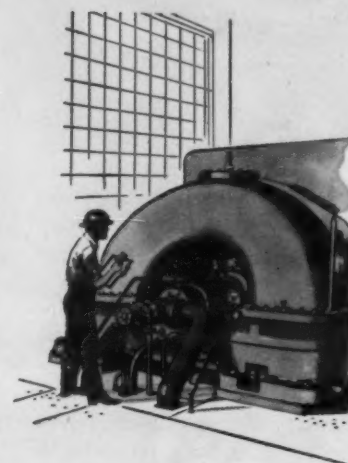
The smooth rolling action of the DeLaval IMO pump eliminates noise, vibration, and hydraulic whine. There are no reciprocating parts to wear and become noisy. "Hospital quiet" is assured. This is why the noise-conscious elevator industry has virtually standardized on the IMO pump for hydraulic passenger elevator installations. For the same reason, the Navy uses IMO pumps for practically every submarine hydraulic service.

## RELIABLE OPERATION

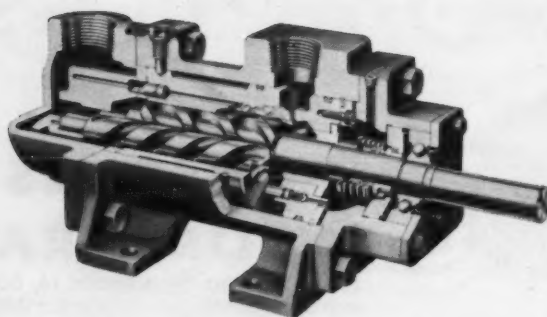


IMO pumps require no timing gears, cams, valves, sliding vanes or reciprocating parts. There is nothing to get out of order, nothing to adjust. IMO pumps for lube oil and fuel oil service are on almost all U. S. Navy combat vessels. They demonstrated their reliability so completely during World War II that the Navy removed IMO pump spare parts from many vessels to allow extra ammunition to be carried.

## HIGH SPEED



Only the IMO pump has proved acceptable for integral mounting on high-speed machinery, such as turbine governor controls. Standard types have given dependable, quiet operation at speeds up to 12,000 rpm. Special types have been built for operation at 24,000 rpm pulling a lift. For many applications at 1750 and 3500 rpm motor speeds, the IMO pump means lower-cost drives.



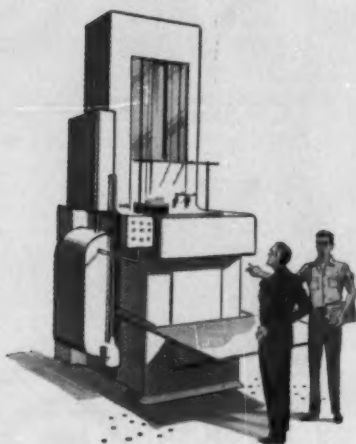
## How the IMO Pump works

The DeLaval IMO pump is a constant-displacement, rotary, screw-type pump. Fluid is propelled axially in a constant, uniform flow through the action of just three moving parts—a power rotor and two idler rotors. The power rotor is the only driven element, its end being extended outside the pump casing for direct connection to the power source. Idler rotors are turned by the action of the fluid pumped and act as sealing elements, their accurately machined threads conforming perfectly to the threads of the power rotor and the surfaces of the housing cylinder.

Since the idler rotors perform no work; the IMO pump screws need not be connected by gears to transmit power between screws. The sealed closures formed by the meshing of the rotors inside the

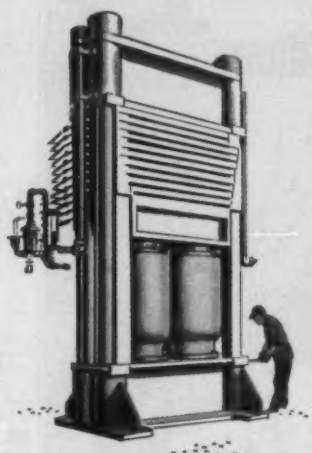
# CHARACTERISTICS - Which are vital to you?

## NON-PULSATING FLOW



Fluid delivery is continuous, resulting in pulsation-free flow. There are no intermittent strokes, no churning. In many broaching operations pump pulsation can adversely affect the finish which is of utmost importance. A non-pulsating IMO pump is ideally suited to such applications.

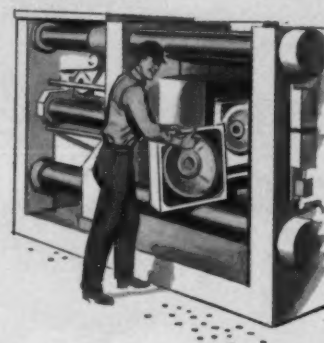
## HIGH CAPACITY



A single IMO pump can deliver up to  
3000 gpm at 300 psi  
1000 gpm at 500 psi  
400 gpm at 3000 psi

Because of its wide range of capacities and pressures, the IMO pump is widely used in hydraulic press applications which, as a rule, require high capacities at low to medium pressures for pre-fill service, then low capacity at high pressure during the working part of the stroke.

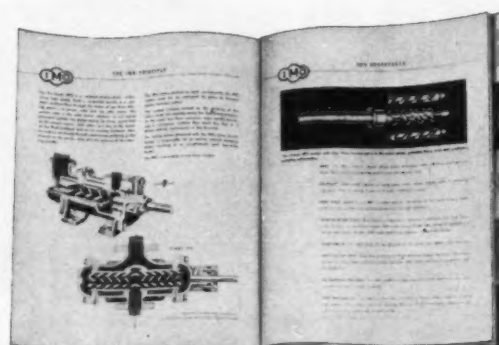
## FIRE-RESISTANT FLUIDS



The IMO pump has been applied widely on phosphate ester and water glycol fire-resistant fluids. Although rotary pumps in general have not performed too well when handling water glycols, the standard IMO pump has been applied with excellent results. To apply the IMO pump on phosphate ester fluids, it is necessary only to change seal and "O" ring materials.

housing enfold the fluid being pumped. As the rotors turn, these enclosures move axially providing a continuous, uniform flow much like that of a piston moving continuously in one direction. The rolling action obtained with the IMO pump screw thread design is responsible for its natural, smooth pumping action and results in exceptionally quiet operation.

For application data, selection information, complete performance on each IMO pump model, dimension drawings and tables, write for Bulletin 3200.



**DE LAVAL**

**STEAM TURBINE COMPANY**

809 NOTTINGHAM WAY, TRENTON 2, NEW JERSEY

## Printed-Board Connectors 347 Booth 228

A device for connecting flat cable to printed-circuit boards or to flexible etched circuitry produces a direct conductor-to-conductor contact without solder. The elimination of crimped and soldered joints permits an appreciable reduction of installation time and affords a high order of reliability. A continuous one-piece spring locks cable into connector. This provides a pressure point at each conductor contact. The "Pos-E-Kon" device can be used to set up test points at any position on flat conductor cable. It can also be used to connect flat conductor cable to flat conductor cable without cutting conductors.

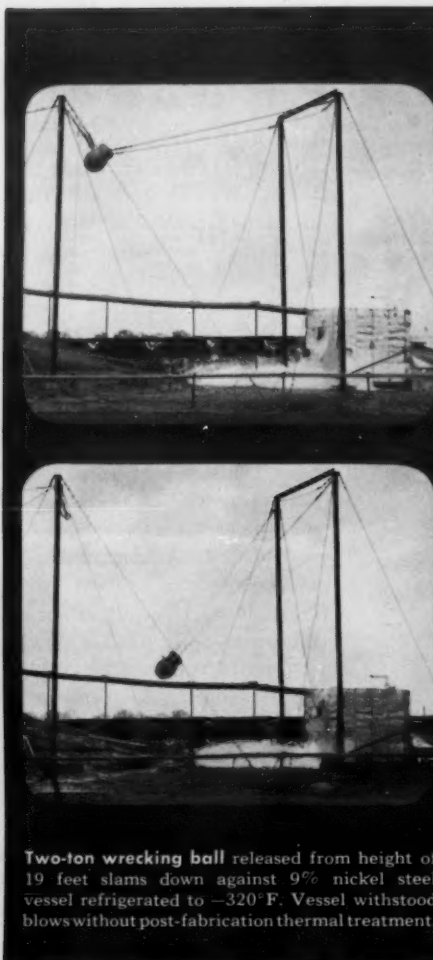
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

## Panel Wiring Raceways 348 Booth 1061

Wiring raceways with pre-formed corners and T connections eliminate handwork involved in constructing raceway networks for panel wiring. Method of panel wiring makes bundling and lacing unnecessary and saves additional time and work by making all wires accessible for final checkout. Corners and T connections are available in a wide range of sizes. Once installed, corners and T connections provide a guide for installation of individual raceways. Raceway is constructed of fiber glass.

Stahlin Brothers, Inc., 498 Maple St., Belding, Mich.





Two-ton wrecking ball released from height of 19 feet slams down against 9% nickel steel vessel refrigerated to  $-320^{\circ}\text{F}$ . Vessel withstood blows without post-fabrication thermal treatment.



IMPACT in "Operation Cryogenics"! At U.S. Steel's Fairless Works, over 82,000 ft-lb blow puts 9% nickel steel vessel to test far more severe than service conditions. "Operation Cryogenics" is a cooperative program of U.S. Steel Corp., Chicago Bridge & Iron Co., and Inco.

## 9% Nickel steel wins giant hammer test at $-320^{\circ}\text{F}$

**"Operation Cryogenics" proves 9% Nickel steel vessels need no thermal treatment after welding**

Imagine the tremendous impact when this two-ton wrecking ball swings down through a long arc and smashes against the steel tank!

Certainly brutal punishment at ordinary temperatures...

But in this test the tank was filled with liquid nitrogen and held at 320 degrees below zero Fahrenheit.

At this ultra-cold temperature, many materials become brittle and shatter under impact. But steel containing 9%

nickel remains tough and ductile. In fact, the yield and tensile strengths of 9% nickel steel actually increase substantially as temperature is lowered.

In test after test, the pressure vessels—not thermally treated after welding—withstanding massive impacts as high as 82,000 ft-lb.

These tests prove that 9% nickel steel, without thermal treatment after fabrication, provides the high strength and toughness for safe, economical pressure

vessels to contain and transport low-temperature liquids.

When you order, design, or build equipment for production, storage, or transport of liquefied gases at temperatures down to  $-320^{\circ}\text{F}$ , specify 9% nickel steel for safety and economy. And for engineering data on 9% nickel steel, and other steels for low-temperature service, write to Inco.

THE INTERNATIONAL NICKEL COMPANY, INC.  
67 Wall Street, New York 5, N. Y.



**INCO NICKEL**  
NICKEL MAKES STEEL PERFORM BETTER LONGER

## ELECTRICAL

**Miniaturized Power Relays 349**  
Booth 1119



This miniaturized unit is conservatively rated at 20 amps per pole at 115v a-c and can be obtained with normally open and/or normally closed contact. The MR-14 features hermetically sealed, silent, mercury-to-mercury contacts within an inert arc-quenching atmosphere. Designed for space economy in single or multiple installations, overall size of the device is only  $4\frac{1}{2}$  by 3 by  $1\frac{7}{8}$  inches. All terminals are up front and easily accessible.

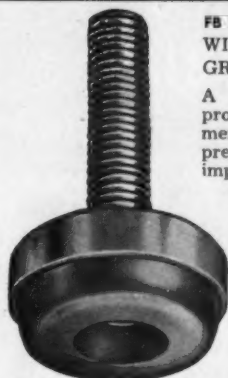
Ebert Electronics Corp., 212-26 Jamaica Ave., Queens Village 28, N. Y.

**Snap-Acting Switch 350**  
Booth 257

"TyniSwitch Type 5" is a precision snap-acting unit enclosed in a phenolic plastic case. The spring mechanism consists of a single beryllium-copper blade. The manufacturer states that fixed mounting of blade, located midway between its actuating and contact ends, assures sharp contact break and almost bounceless make. High contact pressure is achieved through elimination of connection elements, making possible high switch rating in relatively small space. Measuring 1-43/64 by 41/64 by 57/64 inch, this appliance-type unit is rated for 15 amps at 125-250v a-c;  $\frac{3}{4}$  hp at 125v a-c, and  $1\frac{1}{2}$  hp at 250v a-c.

American-Standard Corp., Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.

## OHIO ADJUSTING SCREWS



**FB ADJUSTABLE FEET  
WITH NON-MARKING  
GRAY PAD**

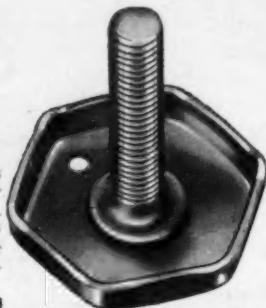
A handsome, sturdy part that provides suction to hold equipment in place, absorb vibration, prevent marring of floors and improve product appearance.

Thread sizes 5/16-18 to 1/2-13

### FT ADJUSTABLE SCREWS

Large hex head gives broad cupped base for easy hand adjustment. Used extensively on appliances as adjustable feet and as hand adjusting screws.

Thread sizes 1/4-20 to 1/2-13



ADJUSTING  
SCREWS

**OVER 50 YEARS OF BETTER FASTENING**

Samples and information available upon request

**THE OHIO NUT & BOLT CO.**

29 First Avenue • Berea, Ohio

Circle 104 on Reader-Service Card for more information

## Big Job, Little Job BALCRANK CAN HANDLE IT! HAND WHEELS



Best quality, fine grain cast iron. Rim and handles polished to high luster. Handles are revolving, solid or omitted. Available in standard sizes 4" to 12" dia. with plating, broaching or other machining to your specification.



### SOLID AND REVOLVING MACHINE HANDLES

Revolving handles turn on HARDENED steel spindle with permanent graphite grease lubrication permitting FASTER, EASIER adjustment by user. Machined from quality BAR STEEL ground and POLISHED to a smooth, high luster.



ASTME Tool Show  
May 22-26  
New York Coliseum  
BOOTH 3237

WRITE FOR FREE CATALOG AND PRICE LISTS TODAY!

Machine  
Tool  
Division **BALCRANK INC.**  
14 DISNEY ST. • CINCINNATI 9, OHIO • U.S.A.

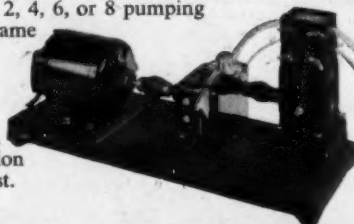
Circle 107 on Reader-Service Card for more information  
DESIGN NEWS—MAY 8, 1961

## AUTOMATION IN COLUMN CHROMATOGRAPHY with the SIGMAMOTOR PUMP

**Vernier Adjustment Insures Accuracy at Low Flows**

Various column chromatography metering operations are simplified by the use of a peristaltic type constant volume pump, such as the Sigmamotor Model T-8. A typical installation combines the Sigmamotor pump with solenoid actuated valves and timing equipment to deliver elutant buffers into ion exchange columns on a reproducible schedule. The T-8 pump is equipped with vernier for accurate flow adjustment.

Single Sigmamotor units can be provided to handle 1, 2, 3, or 4 simultaneous pumping operations. Double units are available to handle 2, 4, 6, or 8 pumping operations at the same time. Capacities from 1 cc to 250 cc/minute are obtained by the vernier adjustment. Complete information available on request.



**SIGMAMOTOR Inc.**

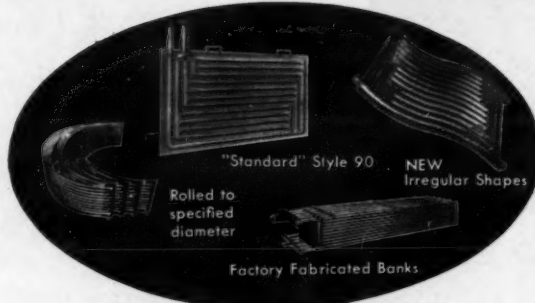
30 NORTH MAIN STREET • MIDDLEPORT, NEW YORK

Circle 105 on Reader-Service Card for more information

## PLATECOIL®

FOR ALL KINDS OF TANK AND PROCESS HEATING AND COOLING

- Built to fit application requirements
- High heat transfer capacity
- Compact units save space
- Easy to install
- Easy to remove for cleaning
- Available in variety of weldable metals
- Operating Pressures up to 250 psig.



"Platecoil" can be furnished to comply with ASME code

Send for  
Bulletin P51



**PLATECOIL®**  
DIVISION

TRANTRER MANUFACTURING, Inc., LANSING 9, MICHIGAN

Circle 108 on Reader-Service Card for more information



## Specify **CLUM** KEY SWITCHES

*Proved Best From The Start*

Clum Key Switches are precision-engineered for continuous dependability in starting and stopping of engines in your high quality products—automotive, tractor, and marine. Available with silver contacts for high current usage.



Type "A" — "Off-run-start."  
Aluminum die cast case,  
iridized, 1/2" — 20 thread.  
Has spring return from the  
start position. A plastic lock  
plug is used with a quad  
ring, sealing switch from  
dust and water.

Available as "Standards" or built to your specifications.

WRITE TODAY . . . for complete engineering data  
and selection information contained in catalog.

Since 1912



**CLUM MANUFACTURING COMPANY**  
611 West National Avenue • Milwaukee 4, Wisconsin

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## WIRE CONNECTORS

BAKELITE • CERAMIC • SET SCREW  
A TYPE AND SIZE FOR EVERY NEED

300, 600 or 1000 VOLTS . . .  
"Hi" HAS 'EM!

Fully listed by Underwriters' Laboratories, Inc. and the  
Canadian Standards Association. MILLIONS IN USE!

✓ CHECK OUR  
PRICES!



SEND FOR  
FREE  
SAMPLES

SPECIFY TYPE AND  
WIRE COMBINATIONS

SEND NEW "Hi" CATALOG

NAME \_\_\_\_\_  
FIRM \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_



**HOLUB INDUSTRIES, Inc.**

476 ELM STREET • SYCAMORE, ILLINOIS

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# 3-IN-ONE AMCO ENCLOSURE SYSTEM

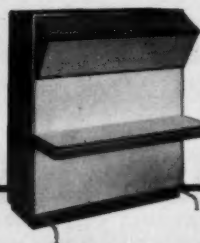
Provides Cooling, Mounting and Lighting in Modular Enclosures for Electronic Instruments in Any Installation



Aluminum



Semi-Custom



Custom

No one type of enclosure meets all environmental and physical demands. AMCO has developed 3 complete systems integrated into 1 system with interchangeable accessories, applicable for both commercial and military use.

**ALUMINUM...Unique! Meets any size...** Flush or recessed mounting of panels. Almost any shape from 13 basic parts... 3 castings & 10 extrusions. Units from 6" to 20 ft.; slopes from 0° to 90° standard. MilSpecs 6062-T6 extrusions and 356-T6 castings.

**SEMI-CUSTOM... Heavy-duty, more internal clearance...** 14 ga. box-channel steel frames, 12 ga. gusseting provides exceptional rigidity both front-to-back and side-to-side. Frames based on 2 1/4" increments provides clearance for recessing 19" wide panels. Meets EIA Standards.

**CUSTOM... When space and appearance are critical...** 16 ga. double-channel steel frames, based on increments of 1 1/4" widths, supports in excess of 3000 lbs. Multi-width panels and cowlings give single-unit appearance with series mounted racks. Meets EIA Standards.

Amco manufactures all necessary blowers, chassis slides, doors and drawers, writing surfaces, cowlings lights and other accessories. **Check the extra savings you get thru Amco's combined-discount system of racks and accessories. PLUS FREE ASSEMBLY.**

Amco is your one complete source of Modular Instrument Enclosure Systems and Accessories. Write today for catalog of complete specifications.



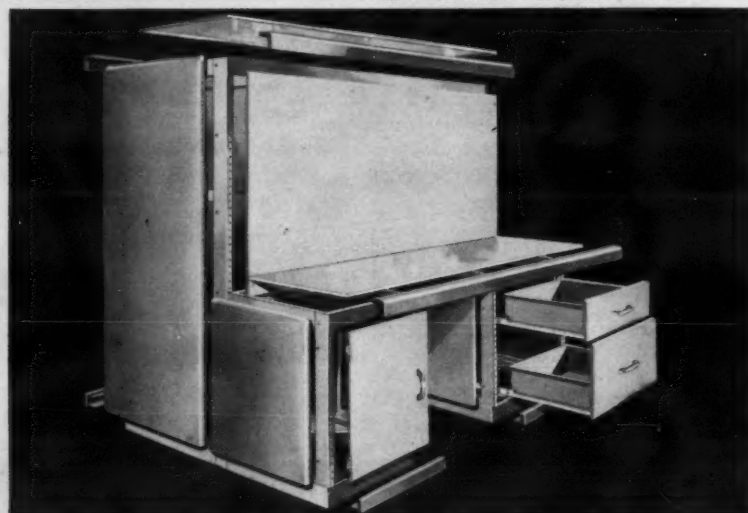
REALISTIC 3 WEEK DELIVERY

Factory trained representatives in principal cities of U.S. and in Canada.



**AMCO ENGINEERING CO.**

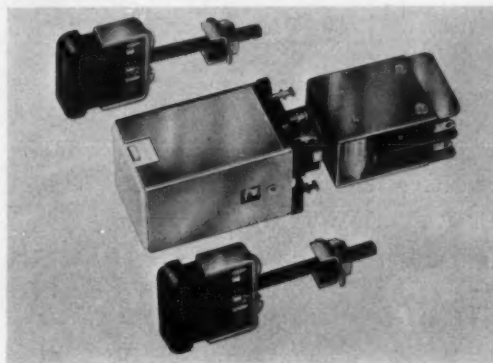
7333 West Ainslie Street, Chicago 31, Illinois



See us at the Design Engineering Show, Detroit, Michigan, Booth No. 449  
Circle 110 on Reader-Service Card for more information

## ELECTRICAL

### Lighted Push-Button Switch 351 Booth 844



The panel-mounted 04 Series switch combines a colored panel light indicator with a double-pole subminiature switch module in a package only 7/8-inch square by 3 inches long. Up to four colors may be displayed at once, giving a quick color-coded readout of circuit conditions. Each switch can control two 5-amp circuits (30v d-c), two 10-amp circuits (125/250v a-c) or a single 10-amp (30v d-c) circuit. A wide variety of colors, color combinations, indicator screen styles and switch modules are available.

Illinois Tool Works, Licon Switch & Control Div., 6615 W. Irving Park Rd., Chicago 39, Ill.

### Heavy-Duty Terminals 352 Booth 1157

Designed to resist heavy vibration that fractures standard terminals, this line of heavy-duty solderless electrical terminals is supplied in more than 200 styles, types and sizes—rings and spades—insulated and noninsulated. Formed from heavy stock (0.050 inch), they provide economical extra protection against terminal failure in any application where high vibration is encountered. Manufactured in 14- and 16-wire range, terminals are crimped with standard 12-10 tooling. All feature 1/4-inch minimum barrel length that eliminates squeeze-outs and shearing and allows a wider crimp for extra-strong connection. Samples are available.

ETC, Inc., 990 E. 67th St. Cleveland 3, Ohio.



## UNIFORM TUBING *always available*

### ALLOYS

Almost any analysis, including aluminum alloys—1100, 3003, high purity, 2024, 5052, 6061, 6951 and the new high strength alloy UT58; copper alloys—OFHC Copper, Phosphor Copper, 70/30 Brass, Yellow Brass, Red Brass, 18% Nickel Silver, "A" Phosphor Bronze, #25 Beryllium Copper, 30% Cupro Nickel; Nickel alloys—"A" Nickel, Monel, Inconel; Stainless Steels—304, 310, 316, 321, 347, 410; Glass-to-Metal Sealing alloys—#52 Nickel-Iron, "Rodar"; Precious Metals.

### SIZES

O.D. from .625" to .005". Wall thicknesses down to .001".

### TOLERANCES

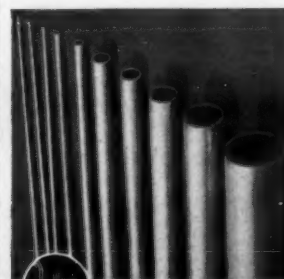
Commercial or precision—down to ±.00025" on smaller tubing.

### FABRICATION

Have your tubular parts "made at the mill"—by skilled tubing fabricators, on specially designed tools in our extensive forming and machining plant.

Cut subcontracting cost, concentrate responsibility, get better delivery and better parts, ready for assembly.

Write for new catalog.



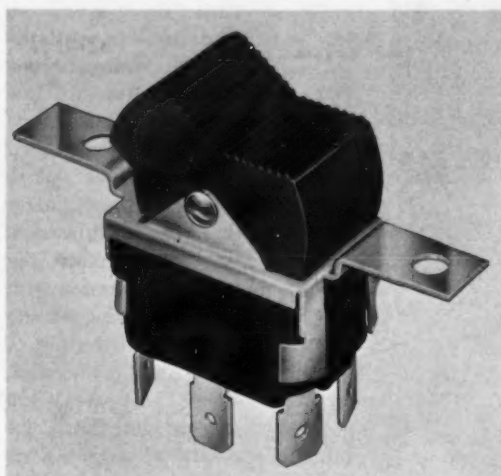
**UNIFORM TUBES, INC.** COLLEGEVILLE 2, PA.

HUXLEY 9-7276 TWX CGVL 1044

Circle 111 on Reader-Service Card

## Rocker-Actuated Switch Booth 1031

353



An a-c rocker-actuated switch is available with flush or offset two-hole mounting. Switch features heavy-duty construction, attractive appearance and a high degree of adaptability to specific application requirements. Electrical ratings of this series include: 20 amps, 125v a-c, 1½ hp; 10 amps, 250v a-c, 2 hp; UL-approved at 10 amps, 125v a-c, "L" rating. Basic switch housing is 1.200 inches in length and 0.762 inch in width. It is made of impact-resistant molded phenolic. Contact rivets are silver cadmium oxide inlaid on special copper-alloy material. All connecting parts and terminals are silver-plated. Cover plate is of cadmium steel.

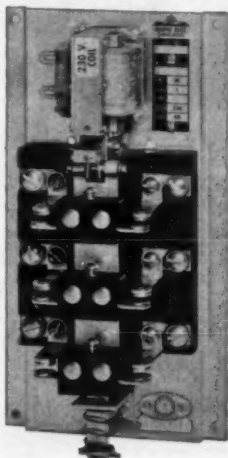
McGill Mfg. Co., Inc., Electrical Div., Valparaiso, Ind.

## Solenoid Contactor Booth 1237

354

The Model SC-33 contactor is designed for applications where space is limited. It can be supplied in 25- or 50-amp sizes and with up to 20 poles. The unit is adapted for control of lighting circuits or for special timing applications for control of three-phase motors up through 3 hp.

Zenith Electric Co.,  
152 W. Walton St., Chicago 10, Ill.



## Tough, durable Mylar® cuts costs...improves product performance

For example, "Mylar"® polyester film gives many products extra resistance to chemicals, moisture and aging...lengthens their life. Today, "Mylar", with its high tensile strength in thin gauges, is improving the performance of products as different as wire and cable tapes and loose-leaf-sheet protectors.

Can this unique plastic film and products made with it help you? For more information on "Mylar", write the Du Pont Company, Film Dept., Room S-8, Wilmington 98, Delaware.



"Mylar" is Du Pont's registered trademark for its brand of polyester film.

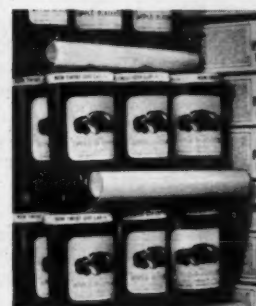
Better Things for Better Living...through Chemistry



**1.** Conveyor belts of "Mylar" are easy to install, need fewer replacements, are easy to keep clean...cut "downtime," reduce costs.



**2.** Age-resistant recording tapes of "Mylar" won't ever dry out or get brittle...are highly stretch- and break-resistant...assure lasting fidelity.



**3.** Roll-back shelving of "Mylar" gets rid of retail stacking and stocking headaches. As shoppers remove items, "Mylar" rolls back.



See DuPont's complete line of industrial films at the Design Engineering Show, Booth No. 860  
Circle 112 on Reader-Service Card for more information



## PARCO PROBLEM PROBERS

### Consistent O-Ring Quality

The quality and dependability of any pressurized hydraulic or pneumatic control or operating system hinges largely on the leak-proof properties of the seals used to segregate pressure differentials within the system. In many systems, molded rubber "O" Rings are used for this purpose. These "O" Rings must provide a dead-tight seal at all times regardless of operating temperature within the specification range. They must be totally resistant to system fluids or gases and must maintain physical constants throughout their operational life. For many years Parco has been one of the nation's major producers of "O" Rings which meet these varied and rigid requirements. With these two requirements met, resistance to system fluids or gases — resistance to temperature variations, and maintenance of physical constants automatically follows. These features add up to the consistent high quality and leak-proof properties which have made Parco "O" Rings a synonym for failure-free operation.

Send for  
your latest  
Parco Slide Rule



**Plastic and Rubber Products Company**  
2100 Hyde Park Boulevard  
Los Angeles 47, California

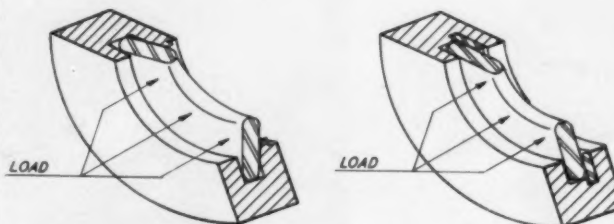
**Plastic and Rubber Products Company**  
2100 Hyde Park Blvd. • Los Angeles 47, Calif.  
Please send the Parco O-Ring Data Chart to:

NAME \_\_\_\_\_  
COMPANY \_\_\_\_\_  
BUSINESS ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_  
ZONE \_\_\_\_\_ STATE \_\_\_\_\_

Circle 113 on Reader-Service Card for more information

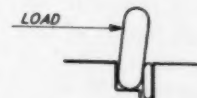
## MATERIALS

### Retaining-Ring Groove Guard 355 Booth 1215



The plastic flow of metal in retaining-ring assemblies due to low yield strength of groove material is controlled by this groove guard. The company states that the guard, a thin, single-turn, wound ring used in connection with a retaining ring, creates a better distribution of force across groove wall. Use of the guard increases the thrust capacity of a given retaining-ring assembly by as much as two times.

Ramsey Corp., Subsidiary of Thompson Ramo Wooldridge, Inc., P. O. Box 513, St. Louis 66, Mo.



### PRECISION IS SYNONYMOUS WITH BOEHME CRAFTSMANSHIP

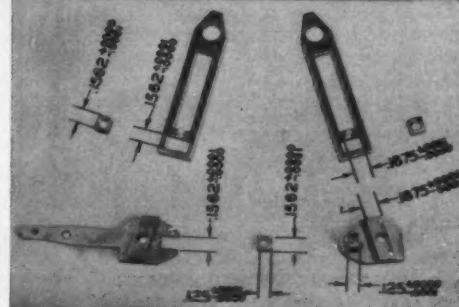
Precision is our business. We have been pioneers in the engineering, design, and manufacture of the precision demands in the field of Instrumentation and Automation.

The parts shown in the figure, held to the tolerances indicated, are typical examples of Boehme skill in precision craftsmanship.

Any or all of our precision production facilities are available to you. Write or call us, there is no obligation.

#### H. O. Boehme, Inc.

Contractors, Designers, Manufacturers  
of Precision Electrical, Electro-  
Mechanical and Electronic  
Equipment since 1917  
915 Broadway  
New York 10, N.Y.



Circle 114 on Reader-Service Card for more information

DESIGN NEWS—MAY 8, 1961

**Welded-Steel  
Tubing  
Booth 811**

**356**

Electric-resistant welded-steel tubing is offered in round, square and rectangular shapes and heavier wall thicknesses. Tubing is now manufactured in sizes up to 7½ inches OD by 0.375 inch wall, round; up to 6 by 6 by 0.259 inch wall, square; and up to 7½ inches major dia by 0.259 inch wall, rectangular. Tubing is made in mechanical and pressure grades and is obtainable also as cold-drawn tubing in sizes up to 7¼ inches. Seamless tubing, in carbon and alloy steels, is produced in sizes up to 7 inches OD. This product is also available cold-drawn. It is manufactured in mechanical, pressure, aircraft mechanical and air-frame grades.

Ohio Seamless Tube Div. of Copperweld Steel Co., Shelby, Ohio.

**High-Strength  
Alloy Steel  
Booth 563**

**357**

This material, 150 and 180 Alloy, is 4100 Series 0.40 minimum carbon alloy steel bars. The material takes the place of quenched and tempered-bar steels, eliminating heat treating and costly secondary operations. Alloy 150 has a minimum guaranteed strength of 150,000 psi and a minimum guaranteed Rc 32 hardness. A higher strength level is offered by 180 Alloy with a minimum guaranteed tensile of 180,000 psi and Rc 38 hardness. Of interest to designers are the machining qualities of both alloy steel bars. While problems of machinability increase with hardness, it appears that these steels will machine faster than heat-treated-in-the-bar steels and compare favorably with annealed, cold-drawn 4140.

La Salle Steel Co., P. O. Box 6800, Chicago 80, Ill.



Circle 115 on Reader-Service Card

# ENGINEERING NEWS - #10

## LIGHTED PUSHBUTTON SWITCHES

CHECKED

*hed*

ENGR.

*W.E.M.*

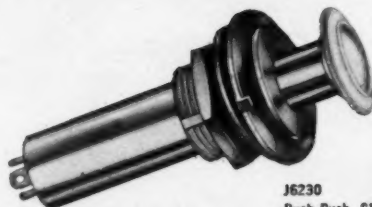
CONTROL SWITCH DIVISION



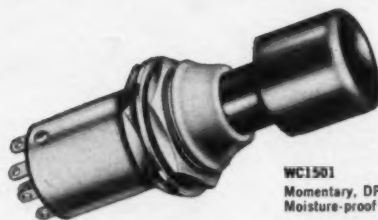
A3311  
Momentary, N.O.  
or N.C. (A3312)



A3298  
Momentary, SPDT



J6230  
Push-Push, SPDT



WC1501  
Momentary, DPDT,  
Moisture-proof



**TWINLITE . . . lights in 2 colors**

Here is a low-cost lighted pushbutton containing two lamps which may be individually circuited. Plastic lens is 1" x .740", and comes in one solid color, two-color split, engraved or with a nameplate slot. Select double-pole or triple-pole switching with push-push, momentary, or solenoid-held action. TWIN-LITE mounts individually with barriers, in rows, or a matrix.

These five models indicate only a part of the full line of SWITCHLITES made by Control Switch Division.

These units combine both switch and indicator light in a single rugged, compact assembly. They are available with momentary, push-push, or push-pull snap-action, having a positive feel. There are eight basic case styles, 20 circuit arrangements. Switch ratings from 2 to 20 amps, ind. or 10 to 20 amps, res. at 28 VDC—depending on switch type, circuit, and required operating life. Switchlites use a midjet flange base MS25237 lamp, 6, 14 or 28 volts. Choose from five styles of plastic pushbuttons in standard transparent and translucent colors.

In other words, almost any requirement you may have for a compact lighted pushbutton is available in a standard SWITCHLITE from Control Switch Division. For more technical data write for free literature.

Manufacturers of a full line of switches, controls and indicators for all military and commercial applications. All standard units stocked for immediate delivery by leading parts Distributors.

**CONTROLS COMPANY**



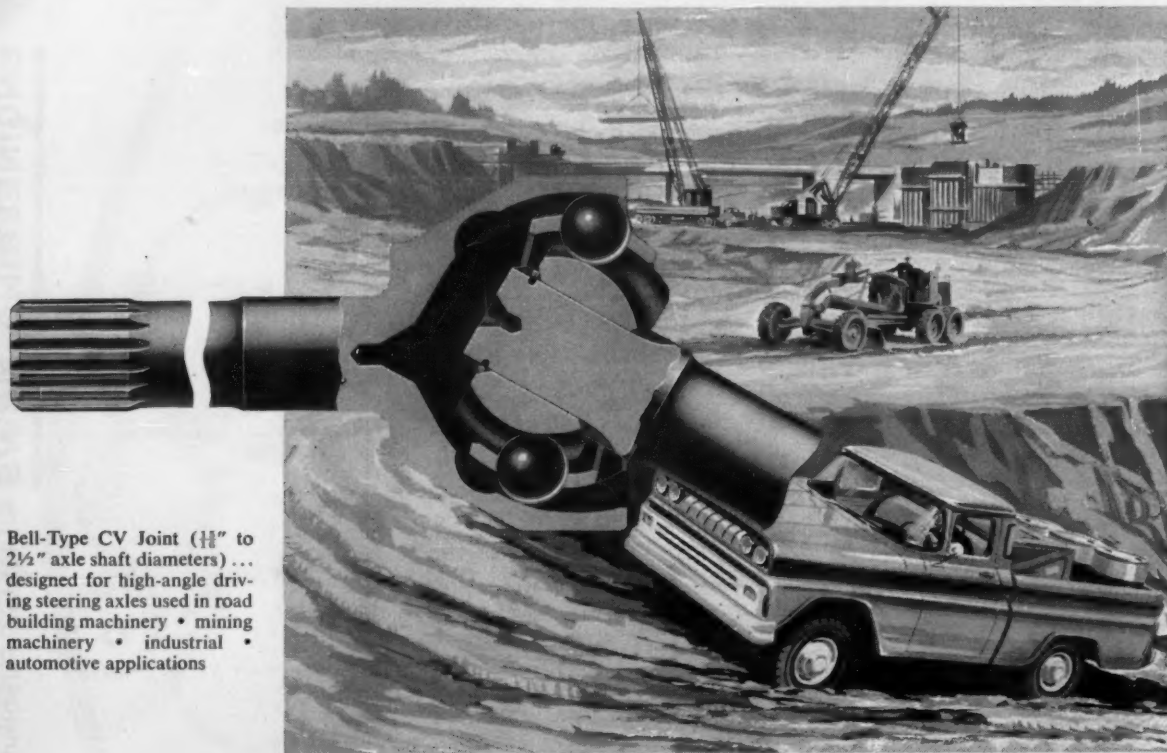
**OF AMERICA**

**CONTROL SWITCH DIVISION**

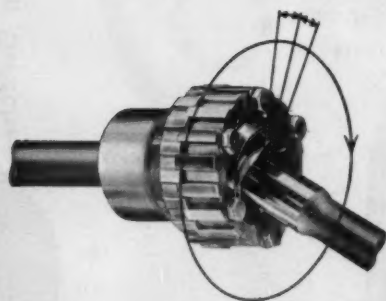
4226 West Lake Street • Chicago 24, Illinois  
TELEPHONE: VAn Buren 6-3100 • TWX CG-1408



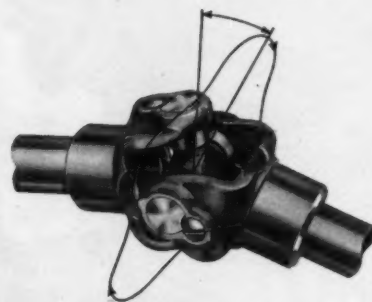
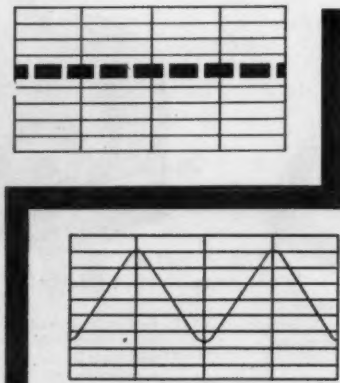
# CON-VEL (RZEPPA) CV Universal Joints Give Longer Life, Higher Torque Capacity!



Bell-Type CV Joint ( $\frac{1\frac{1}{2}}$ " to  $2\frac{1}{2}$ " axle shaft diameters) ... designed for high-angle driving steering axles used in road building machinery • mining machinery • industrial • automotive applications



Disc-Type CV Joint (from  $2\frac{1}{8}$ " to  $16\frac{1}{4}$ " swing diameter) ... designed for all types of industrial drive applications. Rzeppa Joints always transmit torque smoothly, even at unbalanced angles. Note constant velocity of 100% for Rzeppa Joint.



During rotation at a given angle, pin or slipper-type joints speed up, slow down twice during one revolution, as shown by the solid line in the graph.



## CON-VEL DIVISION

DANA CORPORATION

3901 Christopher  
Detroit 11, Michigan

### WRITE

for your free copy of this new engineering data folder on the complete line of Rzeppa constant velocity joints.



## MATERIALS

### Nylon Bushings Booth 218

358

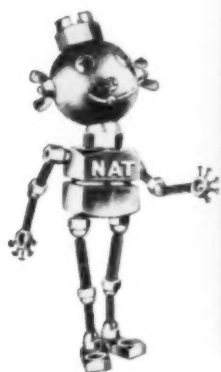
Nylon bushings are available for such applications as insulating and harnessing through panels or chassis. The snap bushing is useful for insulating wires, cables or harnesses through panels or chassis. For filling chassis holes, "Heyco" hole



plug is recommended. The nylon strain-relief bushing is useful for insulating and anchoring power-supply cords, cable or harnesses through panels or chassis. The junction-terminal bushing is designed for insulated receptacles for quick and easy connection or disconnection of wires at their entry through chassis.

Heyman Mfg. Co., 147 N. Michigan Ave., Kenilworth, N. J.

NAT'S  
quick facts  
about  
Fasteners...



## Welding Fasteners...

the little things that make a big difference

Welding Fasteners put threads into the most unlikely places, and make light of the weightiest assembly problems.

Where hands and wrenches can't get in, for instance, or where material dimensions or contours make it next to impossible to use regular fastening methods, Weld Nuts or Weld Screws neatly side-step the difficulties... and make assembly simple, fast and foolproof.

We could go on and tell you more about Welding Fastener advantages... in improving product design and quality, increasing production efficiency, and cutting costs... and we'll be very glad to, if you like.

Right now, though, we'd just like to say that when you need certain standard

Weld Nuts or Weld Screws, and you want to be sure they're designed right and made right... that's where we come in. We *know* Welding Fasteners, and we *stock* many of the most commonly used.\*

We might just mention, too, that we happen to be particularly adept at developing Special Fasteners for welding. They can often be designed to do a better job and save money for you. Ask us about your applications.

\*Standard types and sizes are illustrated and listed in National's booklet on Welding Fasteners. Write for your copy.



The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

Circle 117 on Reader-Service Card for more information

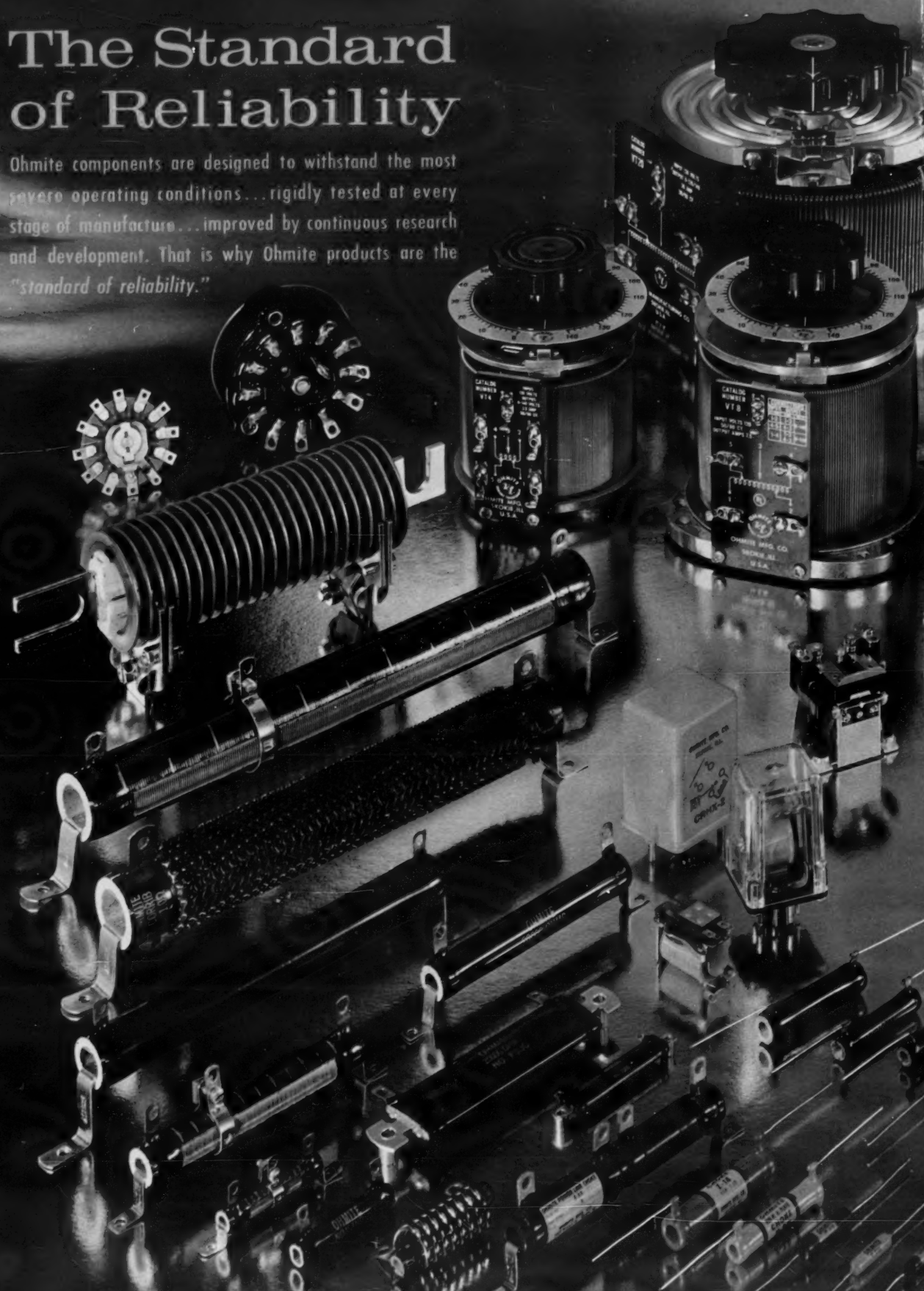
Circle 118 for more information on Ohmite Products shown inside





# The Standard of Reliability

Ohmite components are designed to withstand the most severe operating conditions...rigidly tested at every stage of manufacture...improved by continuous research and development. That is why Ohmite products are the "standard of reliability."





# OHMITE

RHEOSTATS • POWER RESISTORS • PRECISION RESISTORS  
VARIABLE TRANSFORMERS • TANTALUM CAPACITORS • TAP SWITCHES  
RELAYS • R.F. CHOKES • GERMANIUM DIODES • MICROMODULES

Request Catalog from **OHMITE MANUFACTURING COMPANY**  
3637 Howard Street, Skokie, Illinois



# CLICK... ANOTHER NICKEL SAVED



Pivot pin placed in fixture mounted anvil... dial loaded on anvil... fixture slid into position... rivet set in dial and crimped to pivot pin.



## PAR Process Riveting Eliminates Machined Part ... Saves 5¢ on Every Dial for Dinsmore Instrument Co.

It's the world's oldest maker of automobile compasses, but Dinsmore is modern as the day after tomorrow when it comes to searching out cost-cutting production processes.

Take the little item of attaching the pivot to the dial with a relatively costly screw machine part. Could a way be found to do it with a rivet and an automatic riveter? A way that would not sacrifice essential high accuracy in concentricity and length of the completed assembly?

Dinsmore got a "Can Do" answer from the TRS man, trained in the PAR Process approach to problems. A specially designed rivet, anvil and simple fixture for a TRS Riveter ended all need for a screw machine part... actually saved 5¢ each time the TRS Riveting Machine clicked home another rivet! A total saving of over \$5,000 a year on automobile compasses led Dinsmore to use the same method for reducing costs of marine and aircraft compasses.

### FIND OUT what the PAR Process can save you

The PAR Process starts with a search by your TRS man for ways to eliminate or simplify and speed up steps in assembly. It is made effective by specially organized TRS procedures, backed by unique TRS developments in rivets and riveting machines.

The PAR Process may bring you better integration and greater automation of assembly operations, or even a cost-cutting change in basic assembly method. Ask for a check of your operations... it can be worth dollars to you.

*Don't Buy Riveting Machines until you learn how the TRS PAR process revolutionizes riveting*

# TRS®

See us at DESIGN ENGINEERING SHOW  
Booth 350-352, Cobo Hall, Detroit

## TUBULAR RIVET & STUD COMPANY

QUINCY 70, MASSACHUSETTS • TRS SALES OFFICES: Atlanta • Buffalo • Charlotte • Chicago  
Cleveland • Dallas • Detroit • Hartford • Indianapolis • Los Angeles • New York  
Philadelphia • Pittsfield • Quincy • St. Louis • Seattle, WAREHOUSE IN CHICAGO  
See "Yellow Pages" for phone numbers.

*If it's a Tubular Rivet TRS makes it... and Better*



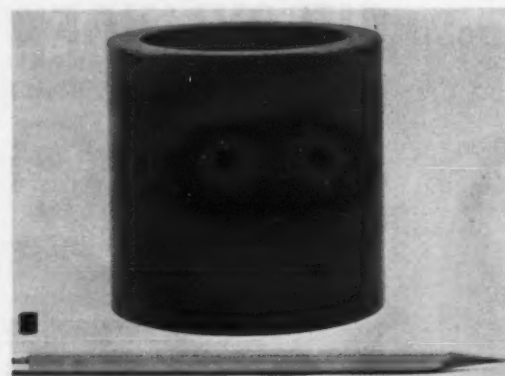
Circle 119 on Reader-Service Card for more information



Circle 118 for more information on Ohmite Products shown inside

## Oilless Bearings Booth 210

359

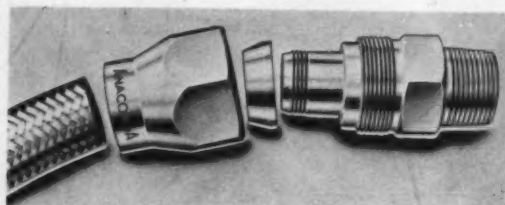


MP oilless bearings are molded from an alloy of plastics that is formed and set under pressure and heat. Result is a bearing material that has good thermal conductivity and no cold flow. Bearings contain dry and viscous lubricants that do not need replenishing. (Manufacturer states that bearings actually operate best with no additional lubrication.) Bearings, on life test, have run continuously for more than 10,000 hr without oil reservoirs or added lubrication and are still in operation. Standard cylindrical and molded plastic oilless bearings are available in a variety of OD and ID dimensions and in various lengths.

Arguto Oilless Bearing Co., 149 W. Berkley St., Philadelphia 44, Pa.

## Tubing Assemblies Booth 312

360



Metal hose and flexible tubing assemblies, including metal-plastic combinations, are offered in Type T4 hose with a core of "Teflon" strengthened by stainless-steel woven-wire braiding, with detachable, reusable end fittings. Hose and tubing are available in a variety of metals, sizes and end fittings of tin, bronze, steel, stainless steel and aluminum. Also offered are hose with a core of "Teflon" and galvanized tubing with an extruded polyvinyl cover.

Anaconda Metal Hose Div., Anaconda American Brass Co., Waterbury 20, Conn.

## Is your materials-handling equipment years ahead of your engineering design equipment?

Save all the money you can with the latest materials-handling devices—but don't overlook your drafting department, either! Professional draftsmen really deserve the latest equipment—it's just *good business* for you to see that they have it.



### Your draftsmen, your productivity, deserve new Hamilton space- and time-saving equipment from Bruning



Top engineers or draftsmen do their very best work at peak efficiency—when they work with high-quality, *professionally designed* equipment. It's a morale-boosting compliment to a good man to give him the *best* equipment. He feels better, works harder, makes fewer errors. And the genuine quality in each Hamilton unit will actually save real money over the years. Why not gain the plus benefits of modern styling at a modest investment—plus the better working atmosphere Hamilton units provide? Our planning engineers are as close as your phone!

**HAMILTON CL-100 TABLE** Entirely new, canted-leg styling assures stability without side crossrails. Strata-Core board, with green linoleum surface, both sides steel edged; tilts 0° to 40°. Fully adjustable recessed footrest; steel reference, tool, and catalog drawers. Other fine features, superb styling in light Sahara Tan, satin-chrome hardware.



**Hamilton L-Contour Table**  
Prestige-assured, individualized work area providing complete board adjustment plus extra storage and reference area.



**Hamilton Unit System Files**  
Provide full protection, accessibility, and classification for all materials to be filed. Occupy minimum floor space.



**Hamilton Auto-Shift Table**  
Built-in mechanism adjusts board to individual height and slope requirements, provides full accessibility, reduces errors.

### Put draftsmen in a "position" to do better, faster work!

Bruning's all-new Neoglide drafters literally help draftsmen straighten up and do faster, better work.\* They provide complete maneuverability on any board at any angle without adjustment! Reinforced U-beam construction assures rigidity, strength, and accuracy. Resistance-free movement of vertical beam and hidden counterweight provide fast "floating" action. Touch-control protractor head gives automatic, pinpoint angle selection.

\*Study of 300 draftsmen showed 35% savings in drawing time—1/5 the backaches—on vertical or near vertical boards.

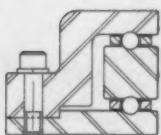


## BRUNING

CHARLES BRUNING CO., INC.  
1800 CENTRAL RD., MT. PROSPECT, ILLINOIS

Circle 120 on Reader-Service Card for more information





## THE SHAPE OF BEARINGS TO COME

This submarine periscope support bearing custom engineered by ITI for Nortronics, a division of Northrop Corporation, is indicative of today's changing bearing concept. By designing limit stop lugs as an integral part of the 17-7 PH stainless steel raceways, available periscope azimuth sweep was increased from 200 to 300 degrees. This is just one example of how engineers are turning to special bearings to solve the formidable problems created by advanced mechanical design. Materials, proportion and geometry may be altered to minimize weight or space, to permit operation at extreme temperatures, or without lubrication. For information on how ITI can design and produce in any quantity other special bearings write for Bulletin AFB-2.



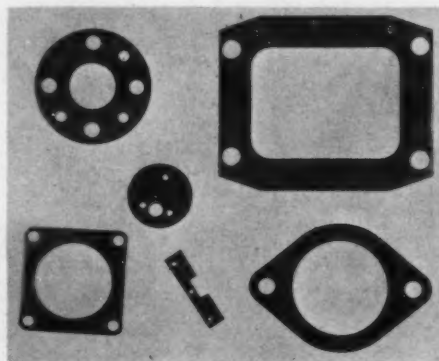
**INDUSTRIAL TECTONICS, INC.**  
manufacturers of precision balls and bearings  
BEARING DIVISION 18301 SANTA FE AVENUE, COMPTON 17, CALIF.

Circle 121 on Reader-Service Card for more information

## MATERIALS

### Dry Film Adhesive Booth 540

361



"Auburn 18" is a dry adhesive film designed as a practical solution to production laminating problems. It is a 2-mil, industrial, thermosetting, dry adhesive film on a paper interliner which permits cutting or preforming to exact size and shape required for optimum mating of the pieces. It provides controlled thickness for a uniform adhesive layer at the glue line and bond. After cure, it is heat-resistant, withstanding exposure to water solvents and hydrocarbons.

Auburn Mfg. Co., Middletown, Conn.

### Pneumatic Seals Booth 105

362



This packing consists of a D-ring, for positive sealing action, and double wedge-shaped backup rings which provide added security, a secondary seal and protection from extrusion. Pressure produces a double-cam action in the wedges, which extends them fully against rod and gland OD and closes rod clearance so extrusion is prevented at both rod and D-ring heel. Rear wedge terminates in a wiper lip and entire assembly installs into a simple counterbore in cylinder head, held by a snap ring.

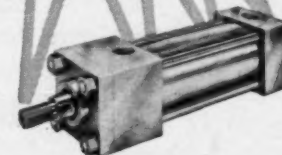
Greene, Tweed & Co., North Wales, Pa.

## NEW O-M AIR CYLINDER

Series K-200 psi

1½" to 14" Bores

Meets JIC Standards




### BUILT TO EXACTING O-M SPEC'S. DIMENSIONALLY INTERCHANGEABLE

Ortman-Miller proudly presents, as an addition to its famous family of air and hydraulic cylinders, the all new Series K Square Head Air Cylinders. Every effort has been made to carry on the tradition of high quality that industry has learned to expect from Ortman-Miller. Such factors as experience, engineering, design, craftsmanship, and the highest quality components have been skillfully blended to assure the high standards of quality.

The O-M Series K cylinders have been designed for maximum operating efficiency, long life, and quick and easy maintenance.

For complete details write for Bulletin No. 115 in which all cylinders have been dimensioned in accordance with NFPA recommendations for your convenience.

	
<b>ORTMAN-MILLER MACHINE CO.</b>	
3 143rd Street, Hammond, Ind.	
<input type="checkbox"/> Have representative call.	
<input type="checkbox"/> Send Bulletin 115	
Name _____	Position _____
Company _____	
Address _____	
City _____	Zone _____ State _____

Circle 122 on Reader-Service Card

**Liquid  
Washer Sealant 363  
Booth 131**

"Loctite" sealant is employed in a wide range of applications to lock assembled parts, hold press fits and seal fittings. Use of this liquid prevents nuts, bolts and other fasteners from loosening under extreme vibration. It simplifies bearing and stud mounting



and is a particularly effective sealing material. The material is a single-compound solution and requires no heat or mixing.

American Sealants Co., 705 N. Mountain Rd., Hartford 11, Conn.



Circle 123 on Reader-Service Card

for crawler drives, transit-mix trucks and other heavy-duty equipment..

*gives you longer service life!*

- accommodates gross sprocket misalignment and severe chain twist
- absorbs greater shock and peak loads
- provides higher working load capacity
- reduces stiffness after exposure to weather, mud, dust and dirt

*Fits all standard pitch sprockets*



Write today for new *Tuf-Flex* folder. Gives engineering features, construction details, specifications and prices...

**DIAMOND CHAIN COMPANY, INC.**  
A Subsidiary of American Steel Foundries  
Dept. 618 • 402 Kentucky Avenue  
Indianapolis 7, Indiana

**DIAMOND**  **ROLLER CHAINS** ®

\*The Trade Mark *Tuf-Flex* is the property of The Diamond Chain Company, Inc.

**VISIT THE DIAMOND CHAIN DISPLAY  
BOOTH 1228-1232  
DESIGN ENGINEERING SHOW  
NEW COBO HALL • DETROIT, MICH.  
MAY 22-25, 1961**

*See Tuf-Flex, Duraweld, Micropitch  
and other new Diamond Chains*



## MATERIALS

### Nameplates Booth 321

364

Mounted on dispenser cards for fast, easy application, low-cost, self-adhesive nameplates are offered in aluminum foil and polyvinyl chloride. Foil nameplates are comparable to other types of metallic nameplates in appearance, permanence and physical properties. Made of 3-mil thin aluminum-foil material, they resist solvents, oil and dirt. They are heat-resistant to 350F. Vinyl nameplates are used wherever permanent color identification is desired. Made of 6-mil durable vinyl plastic, plates conform to flat, curved, irregular or compound-curved surfaces. Printing is unaffected by oil, moisture, abrasion or weather. Samples are available.

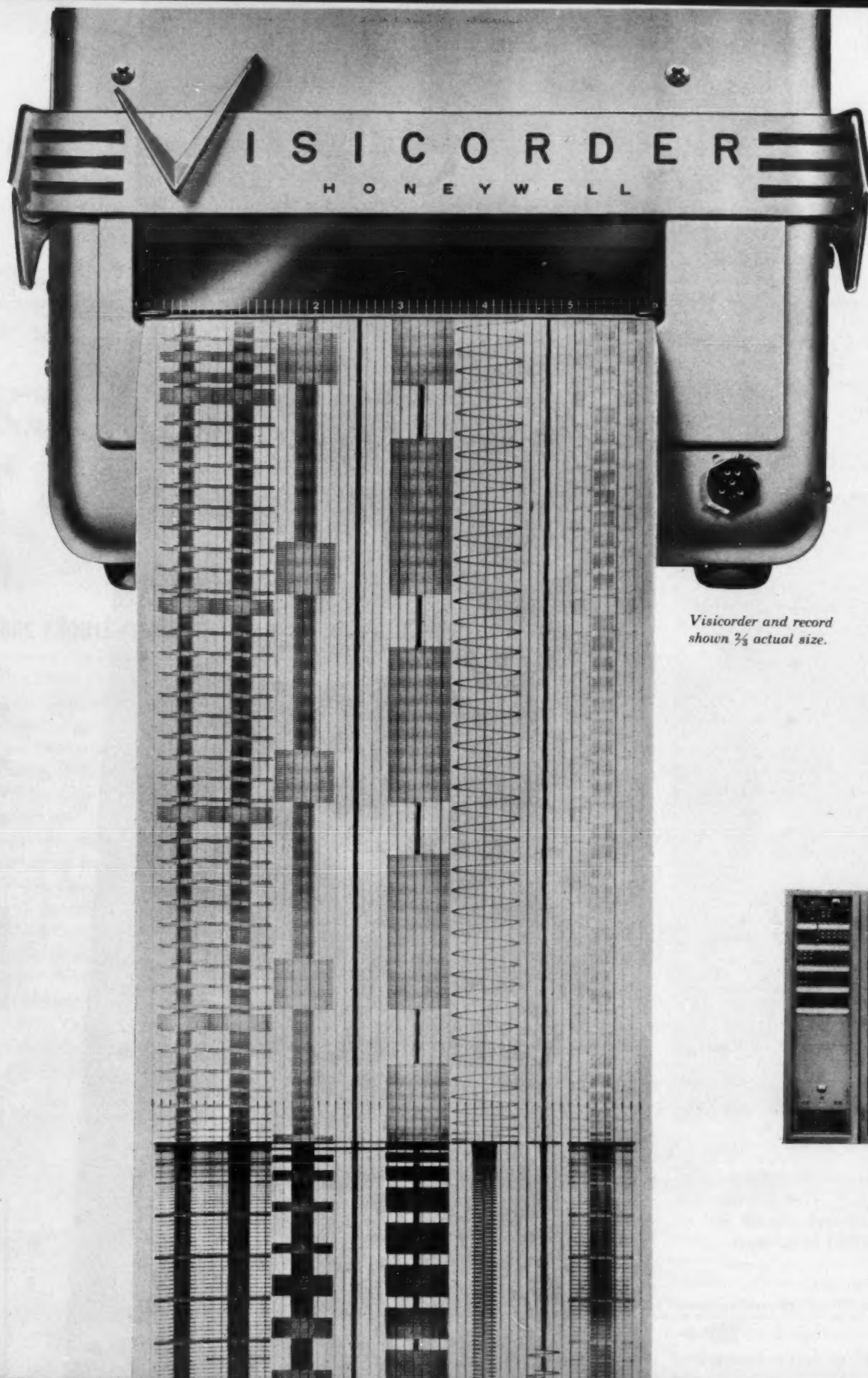
W. H. Brady Co., Dept. 702, 727 W. Glendale Ave., Milwaukee 9, Wis.

### Laminated Plastics Booth 143

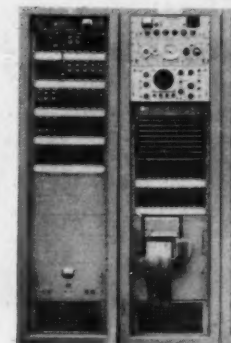
365

Fabricated parts have been manufactured from two fabric-based phenolic materials, Grades C and L, and modifications of these grades, known as Grades CB and LB, and graphitized Grades C-YB and L-YB. Additional special laminates include Grades C-103 and L-103, fabric-based plastics with molybdenum disulphide inclusion. Designed to meet current needs for specialized materials, "Synthane Grades ARF-HT, G3-HT and AA-HT", all high-temperature phenolics, and flame-retardant "Synthane Grades FR-1, FR-2, FR-3 and FR-4" are among the newest plastic laminates. Grade ARF-HT has an asbestos mat reinforcement with a modified phenolic binder for high-temperature resistance (up to 500F). Grade G3-HT offers greater mechanical strength at temperatures to 500F, has a glass-fabric reinforcement and a modified phenolic binder. Grade AA-HT has an asbestos woven fabric reinforcement and a modified phenolic resin binder.

Synthane Corp., Oaks, Pa.



Visicorder and record  
shown  $\frac{2}{3}$  actual size.



## "MASTER CLOCK"

### for the missile range uses 15 Honeywell Visicorder oscillographs

The Timing Operations Center designed and built by Epsco-West for the Navy's Pacific Missile Range is now in use at Point Mugu, California. It makes use of 15 Honeywell Visicorders to read out (as shown on the unretouched record at left) the modulated timing codes distributed as balanced outputs to the Center's "customers."

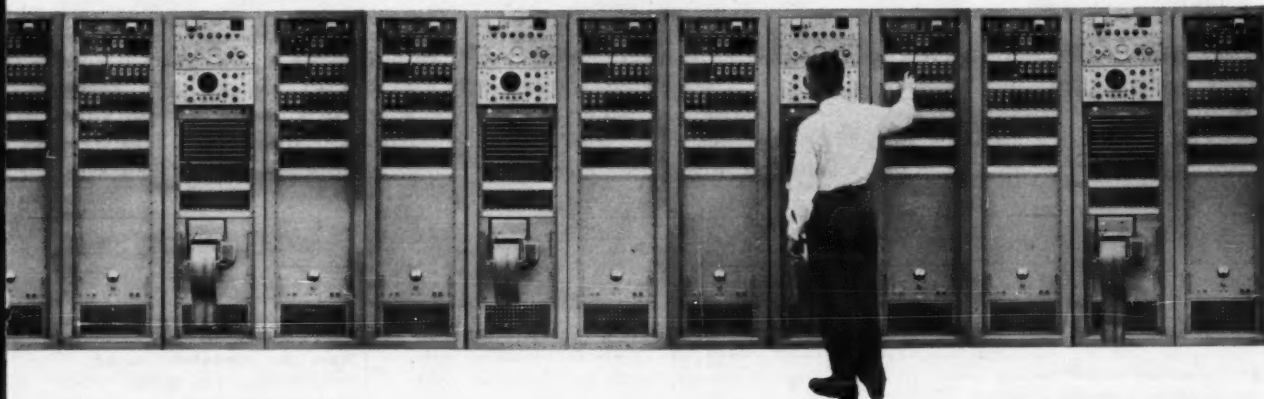
These customers are the test and development crews on weapons systems, satellites, space vehicles or any other users of the facility who depend upon extremely accurate timing signals for many purposes including satisfactory correlation of telemetry data. The TOC generates as many as eleven separate timing signals, any one of which may be delivered to any of 36 users at one time.

Entirely solid-state, the Epsco-West TOC consists of a precision frequency standard, the 100-kc/sec output of which is accepted by the timing signal generator and divided down to one pulse per sec by digital divider units. The 1-pps signal is accumulated in binary-coded decimal format by a counter-type register permuted to read out in hours, minutes, and seconds. Recycling occurs at 23:59:59. Controls include advance or retard in 10-microsecond increments.

The 906B Visicorder also performs a supplementary function as a monitor on the timing and test-patch panel, and as permanent "record-keeper" for the built-in indicators and test oscilloscopes. Visicorders were selected for their jobs with the TOC because of their versatility, reliability, low cost, and compact size (10" x 10" x 15½"; weight, 37 lbs.).

Pioneer and acknowledged standard in the field of high frequency direct-recording oscillography, the Visicorder is available in several models, from 6 to 36 channels, DC to 5000 cps response, up to 20,000"/sec writing speed. Honeywell engineering is at your service through 120 field offices for help in applying one Visicorder or a full system to your data acquisition program; or a quantity of Visicorders for OEM application in your products.

*Call your local Honeywell office now or write today for Catalogs HC906B, 1012, 1108, and 1406 to Minneapolis-Honeywell, Heiland Division, 5200 E. Evans Ave., Denver 22, Colorado. Our telephone is SKyline 6-3681, Area Code 303.*



*Visicorders are conveniently installed in control consoles of three-rack TOC modules. Records are immediately legible without chemicals or developing.*

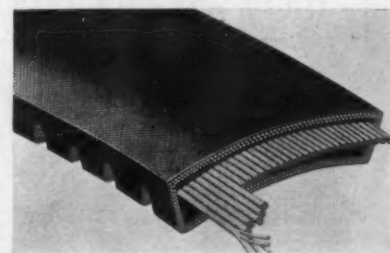
## Honeywell



*Industrial Products Group*

Circle 124 on Reader-Service Card for more information

## Variable-Speed Belts 366 Booth 1044



A line of variable-speed belts in a wide range of sizes and types for industrial applications is offered in 7/8 to 3 inches and nominal overall lengths from 26.4 to 170 inches. Belts are fabricated from fiber-reinforced synthetic rubber which is impervious to oil and heat and remains "live" under static conditions. Length stability, whether in use under severe operating conditions or in storage for long periods, is assured by "stretch-resistant" properties of reinforcing cords. Uniform notching on under side provides ample flexibility without excessive strain or distortion on small pulley applications.

Lovejoy Flexible Coupling Co., 4812 W. Lake St., Chicago 44, Ill.

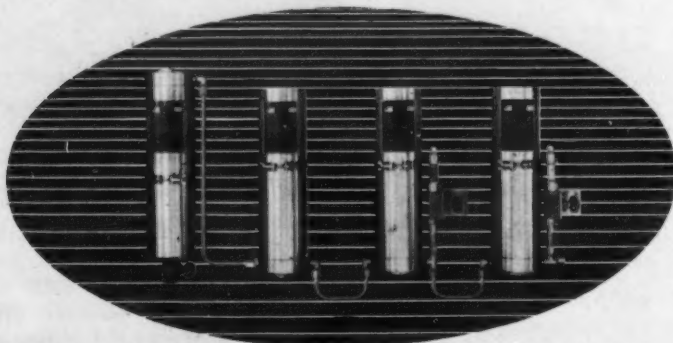
## Decorative Trim 367 Booth 148

"Silvatrim" is a decorative, functional and economical plastic trim molding available in different cross-sections and finishes. Finishes resemble metal and wood grain. Metal finishes are satin or bright brass, copper, gold and chrome. Woodgrain trims match the many different patterns of such laminates as "Formica, Nevemar, Kevanite, Consolweld, Textolite, Pionite, Panelyte and Micarta". Solid colors are also available. This material is made by sandwiching aluminum foil between two thicknesses of durable plastic. Layers of plastic form a permanent cover over these materials, protecting finish from scratching, tarnishing or wearing off.

Silvatrim Mouldings Div. of Glass Laboratories, Inc., 863 65th St., Brooklyn, N. Y.



## ROBBINS DEHYDRATION EQUIPMENT



CARTRIDGE TYPE DEHYDRATION & PURIFICATION EQUIPMENT

**PRECISION MADE FOR PERFORMANCE!**

**CARTRIDGE TYPE** PRESSURES TO 12,000 PSI  
... DEWPOINTS TO  $-100^{\circ}\text{F}$  ARE STANDARD  
SAFETY FACTOR OF 4 TO 1 ... OIL VAPOR REMOVED  
AS LOW AS 0.3 PPM/W TOTAL HYDROCARBONS

Robbins disposable desiccant cartridge type drier and purifier equipment is carefully engineered for maximum effectiveness. Chambers are leakproof and cartridges are by-pass proof. Moisture and contaminants in the gas stream are retained in the cartridges, and do not contact the chambers. No tools are needed to change cartridges. Can also be supplied as complete systems, from single to four-chamber, for six maximum pressure ranges and in two maximum flow capacities for each pressure. Porous stone mechanical filters rated at 10 microns are available, as well as fiberglass filterpack cartridges rated at .3 microns.

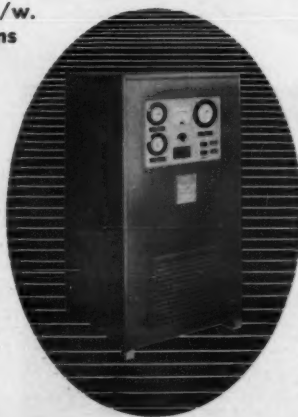
**DESIGNED TO SAVE YOU MONEY!**

### REFRIGERATION SYSTEMS

Oil Vapor Removed to Less than 1 ppm/w.  
Foreign Particles Removed to 10 microns  
Dewpoints to  $-120^{\circ}\text{F}$ .  
Continuous or Intermittent Operation  
Automatically Controlled  
Need No Defrosting

Robbins' refrigeration type gas drier and purification units are individually engineered to meet your needs for the removal of moisture and oil from air, nitrogen, hydrogen, helium, and other gases. Use of refrigeration increases life of desiccant cartridges 8 times with substantial operating cost savings.

Write TODAY for 20-page illustrated brochure in color!



REFRIGERATION TYPE  
DEHYDRATION SYSTEMS  
INDIVIDUALLY ENGINEERED



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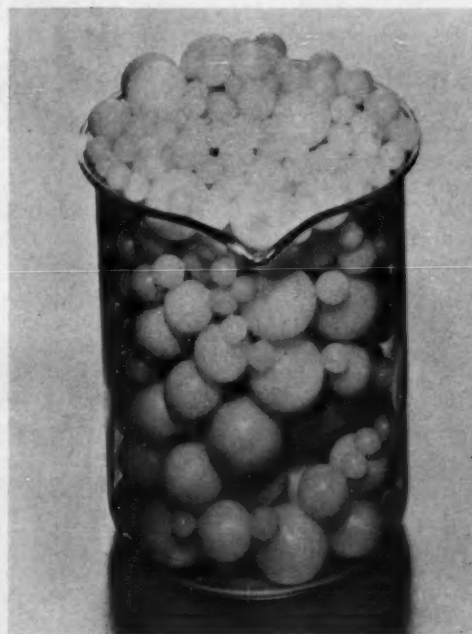
## MATERIALS

### Printed-Circuit Adhesives 368 Booth 560

A complete line of printed-circuit adhesives is obtainable for bonding copper foil to phenolic or epoxy-impregnated base stock phenolic paper, epoxy paper and epoxy glass materials. Since no single adhesive will meet the material, production and bonding requirements of each printed-circuit manufacturer, several adhesives have been developed to meet individual manufacturer requirements. Included in the line of adhesives are EC-1855, EC-1857, EC-2080 and EC-2130.

Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

### Close-Tolerance Spheres 369 Booth 1000



Close-tolerance balls of ceramic, metallic and plastic materials are available for corrosive and extreme-temperature applications. Balls of "Delrin" and "Lexan" as well as the more widely used nylon and "Teflon" in special sizes operate within liquid hydrogen at  $-425^{\circ}\text{F}$  and at  $1800^{\circ}\text{F}$  or above.

Industrial Tectonics, Inc., Ball Div., 3686 Jackson Rd., Ann Arbor, Mich.

## NOW AVAILABLE TO DESIGNERS AND PRODUCT PLANNERS



### What Is PDCS?

Prototype Die Casting Service is a new process which allows the low cost creation of die castings ... in small quantities ... which look, feel, finish and perform remarkably like production die castings.

### Why Was PDCS Developed?

Over a year and a half of intensive research and test was devoted to the development of PDCS to provide a method of supplying sample die castings for test purposes ... without the problem of underwriting permanent tooling charges.

### How Can You Use PDCS?

If part of the product you are planning is to be a die casting and you need prototype die castings to ... supply your customers with samples ... test the function of the completed assembly ... gauge sales appeal by market-testing ... judge the "feel" or appearance of the die casting ... PDCS represents the answer you have been looking for.

### How Much Does PDCS Cost?

Amazingly little. The factors of shape, size, complexity and quantity all play a part in determining price.

### How Can You Start To Work With PDCS?

If you have prints, models, sketches or just an idea of what you need in a die casting ... we are ready to help. Just fill out the coupon ... clip and mail today.

**NEWTON-NEW HAVEN CO.**  
(Key) Third Avenue  
West Haven, Conn.

### CUSTOM PRODUCERS OF DIE CASTINGS

I have a problem to which PDCS may be the answer. Without cost to me or my company ...

- ☐ Prints ☐ Models ☐ Sketches are being forwarded under separate cover. Please submit your cost estimate.  
☐ Have your representative call.  
☐ Send me your free folder, "PDCS ... Prelude to Production".

NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

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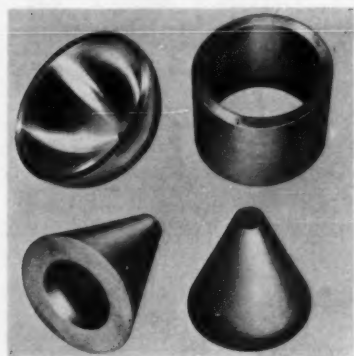
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**Film Adhesives 370**  
**Booth 560**

A structural thermosetting film adhesive offers good curing properties for metal-to-metal bonding and metal honeycomb sandwich construction; contact bond adhesives for industrial applications, and a variety of adhesives for bonding copper foil in printed-circuit production. The adhesive, designated AF-110, can be used for low-pressure bonding, requiring only enough pressure during curing operation to provide contact between parts being bonded and to keep them properly aligned. Material exceeds the requirements of MIL-A-5090D, Type I, for metal-to-metal bonding and MIL-A-25463, Type I, Class 2 for honeycomb sandwich construction. The adhesive provides metal-to-metal shear strength in excess of 4000 psi at 75F service temperature.

Minnesota Mining & Mfg. Co.,  
900 Bush Ave., St. Paul 6, Minn.

**Tungsten Alloy 371**  
**Booth 562**



Pictured are components made of "Kennertium", a heavy tungsten alloy. Outstanding properties of this material include malleability (10 percent elongation) at high tensile strength (115,000 psi) which offers exceptional possibilities for design engineers in certain areas.

Kennametal, Inc., Latrobe, Pa.



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Get your FREE copy of this new edition

# POWER TRANSMISSION AND BRAKING IDEAS

Every Power Drive or Design  
Engineer should have this book...

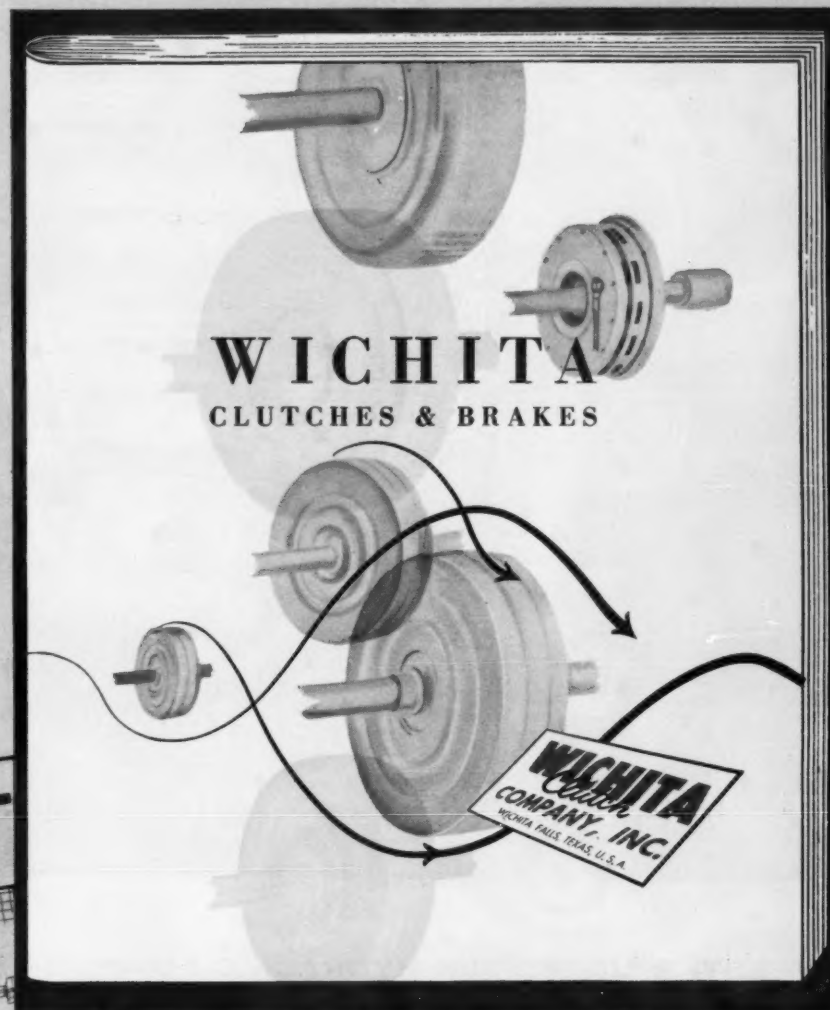
just one idea can help you  
improve operating efficiency  
of your present equipment  
or machinery . . . or help  
you do a better design job  
on new applications.

**TYPICAL  
PAGES**



The new revised handbook  
contains many clutch and  
brake applications...plus com-  
plete catalog information and  
money-saving industrial uses.

**WRITE FOR YOUR COPY TODAY!**



**Wichita Clutch Company**  
P. O. Box 1150 — Wichita Falls, Texas

Send me a copy of your new Wichita Clutch Idea Book.

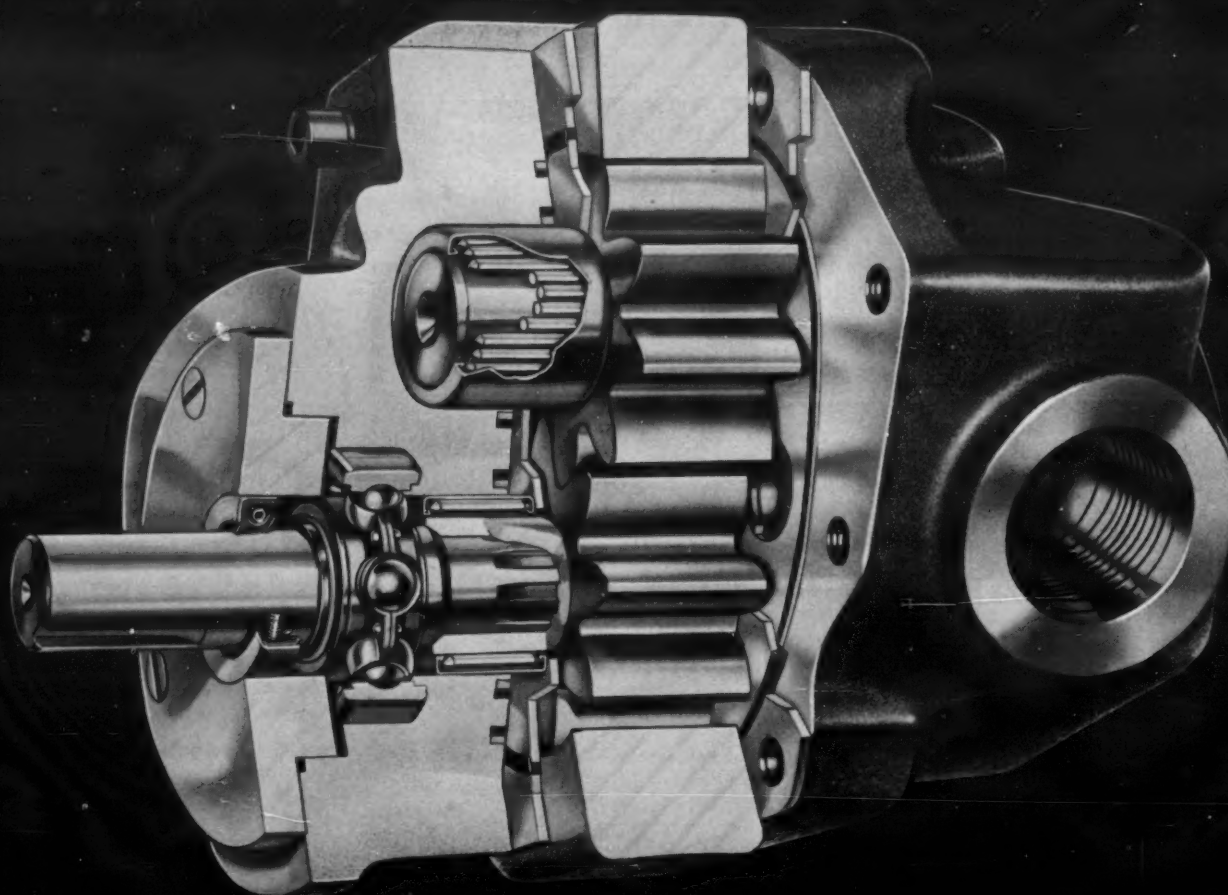
Name \_\_\_\_\_ Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_





**POWER** *for the biggest  
mobile rigs, toughest jobs!*

#### WEBSTER "JD" SERIES HYDRAULIC PUMP

Match your big equipment to the most rugged duty with this newest Webster and you come up with some interesting answers in hydraulic performance. Fluid power up to 2000 psi! Requires less input horsepower! Saves fuel!

This sectioned view and the specifications at right tell the story. The "JD" Series' anti-friction bearings save power, pressure balanced wear plates assure high volumetric efficiency — other equally important features mean extra work output, trouble-free operation!

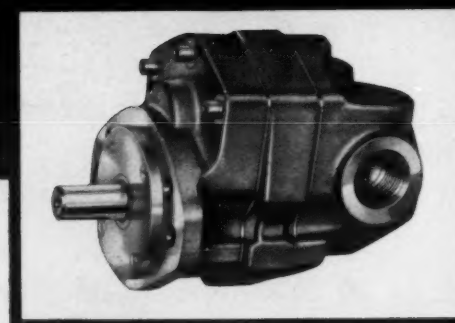
Webster Electric "JD" Series Pump is a trim, *very compact* unit designed to fit in tight locations. Ideal for agricultural, construction, industrial, utility equipment — machine tools as well. It's available in 5 sizes from 5 to 17 gpm — attaches easily with a choice of mountings. Ask your Webster Electric representative for all the facts on this powerful new pump — or write direct for engineering detailed sheet HY1-2.

OIL HYDRAULICS DIVISION

WEBSTER  ELECTRIC

RACINE · WIS

Reprints only, #1728



#### SPECIFICATIONS

**Capacity:** 5 sizes, 5 to 17 gpm.

**Operating Pressure:** Up to 2000 psi.

**Operating Speed:** Up to 2400 rpm.

**Wear Plates:** Pressure balanced — prevent clearance changes from heat.

**Bearings:** 4 anti-friction needle bearings — save power or fuel. Ball bearings on drive shaft to absorb end thrust.

**Gears:** Smooth-running, spur cut. One piece gear and bearing journal units assure minimum deflection and proper alignment.

**Drive:** Free-floating internal spline — eliminates key failures.

**Seal:** Double lip on drive shaft — added protection from seal failure and dirt.

**Porting:** End, side, or bottom.

**Mounting:** SAE Type A, 2-bolt mounting flange standard. Foot mounting optional.

#### MATERIALS

##### Glass-Fabric Epoxy Laminate 372 Booth 156

A new NEMA G-10 glass-fabric epoxy laminate is now available with the advantages of flame retardancy, superior cold punching and increased solvent resistance. The grade is offered copper-clad as "Di-Clad 614" or plain as "Dilecto 614". The principal application for 614 is as printed-circuit boards in ground and airborne computers where performance requirements are particularly exacting. This grade meets NEMA specifications for G-10 as well as NEMA FR-4 (proposed), a fire-retardant G-10. Military specifications MIL-P-13949B, Type GF, are met by "Di-Clad 614" and "Dilecto 614" is pending approval under MIL-P-18177B as Type GEE.

Continental-Diamond Fibre Corp., Subsidiary of The Budd Co., Newark, Del.

##### Precision-Moldable Insulation 373 Booth 1063

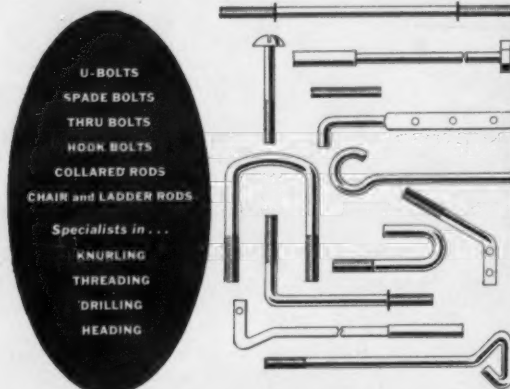
"Supramica 620" ceramoplastic is a precision-moldable, ultrahigh-temperature dielectric. This material will operate at temperatures to 1200F, widening the range of problems ceramoplastics can solve in the vital area of missile and space research. The heat generated by even the most modern high-speed and miniaturized electrical and electronic equipment has no effect on "620" parts. Material retains insulation resistance at elevated temperatures. At 932F, its volume resistivity is 1 times 10<sup>16</sup> ohm/cm.

Myclex Corp. of America, Clifton Blvd., Clifton, N. J.



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**Complete Facilities** for the manufacture of **Special Headed and Threaded fasteners** / from 1" to 60" in length in short or long runs



Send drawings or blueprints for quotes and literature.

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**Poly-Plates** — Add new color, new beauty, new Life to your products with Brady self-bonding Poly-Plates. Give you unlimited freedom in nameplate design. Made of Miracle Mylar® for scratch, scuff, acid and solvent resistance. Permanent sub-surface metallized printing. Sparkling gold, silver—plus all colors. No screws, rivets, heat or activators needed to apply. Stay bright, clean, legible—for the Life of Your Product.

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	HEAT
FOOD	360
BACON	360
EGGS	360
FISH	360
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FRUIT, GRILLED	360
HAM	360
HAMBURGERS	360
LIVER	360
MINUTE STEAK	420
PANCAKES	400
PORK CHOPS	360
POTATOES & VEG.	340
ROLLS	340
ROLLS, WARMING	260
SAUSAGE	320
SIRLOIN STEAK	420
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See recipe book

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Colorful Anodized ALUMI-THIN Nameplates with permanently etched printing.

**BRADY-CALS**



Pressure-sensitive, Super-thin Vinyl Nameplates. Top-surface Printed . . . Enduro-Kote Over-coating protected.

WRITE FOR INFORMATION AND FREE TESTING SAMPLES

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Manufacturers of Quality Pressure-Sensitive Industrial Tape Products, Self-Bonding Nameplates, Automatic Machines for Dispensing Labels, Nameplates, Masks and Tape • Est. 1914.

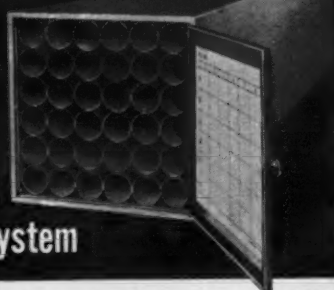
In Canada: W. H. BRADY CO. OF CANADA, LTD. 95  
1 Research Road, Brampton, Ontario, Phone Glendale 1-4420

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DESIGN NEWS—MAY 8, 1961

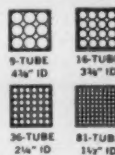
## STACOR Lifetime Steel Staktube Roll File

low-cost—  
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Rolled drawings, maps, plans, blueprints, etc., stay cleaner, safer, easier to find in the new space-saving Staktube Roll File System. All steel-encased 15 1/2" Square File complete with steel-rimmed tubes; 32 sizes—4 ID's, 8 lengths: 18", 24", 30", 36", 42", 48", 54", 60". Files bolt together for stacking to any height. With locks if desired.

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## HAMLIN electrical and electronic components



**MAGNETIC REED SWITCHES**

Operate in any position — hermetically sealed — use in wet, dry, or "explosive" atmosphere. Not affected by high or low temps. Compact, rapid cycling, long life.

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Excellent for gyroscopic correction mechanisms. Not materially affected by vibrations. Keeps "hunting" to minimum. Compact — extremely accurate.

**MERCURY SWITCHES**

Many design ideas. Super-sensitive — sealed against trouble. Select from huge variety of electrical and operating characteristics, contacts, lead and terminal arrangements. Custom designs upon request.

✓ **Specify HAMLIN** for systems to indicate or integrate functions of: RPM's thru circuits • TIME • MOTION • MEASUREMENT • TEMPERATURE • POSITION • SEQUENCE • FLOW • PRESSURE • LIQUID LEVEL

✓ **Specify HAMLIN** if you manufacture: TEMP. or FLOW CONTROLS • IND. PROCESS CONTROLS • ALARM DEVICES • GYROSCOPIC INSTRUMENTS • AUTOMATION • ATOMIC POWER REACTORS • RELAYS

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**25**  
years in  
progress to  
this date

- Reduce costs
- Simplify assembly
- Improve appearance with

## GRC DIE CAST ZINC ALLOY & MOLDED NYLON FASTENERS

NOW!  
NYLON SCREWS  
AND NUTS  
also available  
in Delrin



MACHINE SCREWS from miniature #20 thru 1/4" in wide range of lengths and head types.

Also SET SCREWS, NUTS from #2 thru 5/16".

GRC's wide selection of molded fasteners available from stock. Samples sent immediately.

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DESIGN SHOW—#1143;  
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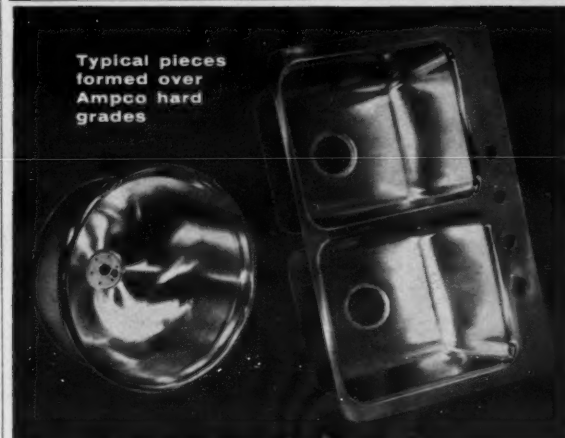
**GRIES REPRODUCER CORP.**

World's foremost Producer of Small Die Castings

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Ampco hard  
grades



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**NEW, IMPROVED AMPCO ALLOY**

for drawing and forming stainless steel and other clean materials. Longer life between dressings. Improved machining qualities. Better impact resistance . . . Die blanks in stock as rectangles, solid rounds, and circles — diameters to 20". Also cast to your required shape . . . Write for copy of free bulletin today.

D-84



**AMPCO METAL, INC.**

Dept. 44E, Milwaukee 1, Wisconsin  
Huntington Park, Calif. Garland, Texas

Circle 134 on Reader-Service Card for more information

DIE CAST  
ZINC ALLOY





# STOP!



## Look what happened when A. W. Haydon designed a new LABORATORY STOP CLOCK

You just won't find these features in any other stop clock. This versatile timer-of-all-work was designed by engineers who understand timers and timing...and who needed a precise time reference in their own work. **Timed outlet**—energized whenever clock runs, supplies 115V, 60 CPS, 3 amp to time and control external loads simultaneously...manually or automatically. **External Run Socket**—for remote running, using a control cable... manually or automatically (when wired into a system). **Clutchless timing mechanism**—needs no warm-up, make-ready or pre-start. Synchronous motor starts and drives instantly. No power consumed except during timing and reset. **Independent RUN and RESET** buttons for manual, local control. **Schematic diagram** and control circuitry silk-screened on bottom of housing for ready reference. ■ Bench type precision stop clocks are available with optional remote control for manual or automatic running and/or resetting. Clocks operate on commercial 115V, 60 CPS power; accuracy is  $\pm 25$  milliseconds.

Low power drain: only 2 watts, timing. Sweep second scale calibrated in 10 millisecond increments; totalizer scale calibrated in seconds, up to 1 min. Sturdy instrument case requires only  $4\frac{1}{4}$ " square bench space. For complete specifications, write for Bulletin ET-702. Ask also about panel-mounting versions.



**THE AWHAYDON COMPANY**  
236 North Elm Street, Waterbury 20, Connecticut

Circle 135 on Reader-Service Card for more information

## MATERIALS

### Decorative Metallic Paint 374 Booth 745



"Metallflake" can be used for safety as well as decorative purposes on objects ranging from industrial machinery and office equipment to automobiles and around-the-house articles. The paint is composed of minute precision-cut particles of coated aluminum foil and is produced in six basic colors—silver, gold, copper, red, blue and green. Each can be used separately or in attractive multicolor combinations. The paint will not tarnish, lose its color and brilliance, or grow muddy during use. Material is mixed with and suspended in lacquer, applied with standard paint-spraying equipment, then covered with several coats of clear lacquer for a smooth finish. The sparkling material is available in two particle sizes— $1/64$  by  $1/128$  inch and  $1/130$  by  $1/230$  inch—designated as numbers 1 and 2, respectively.

Metallflake, P. O. Box 6417, Cleveland 1, Ohio.

### Stainless-Steel Foil 375 Booth 416

Self-adhesive, 0.003-inch, stainless-steel foil has all the protective advantages of ordinary stainless steel without the need for mechanical fastenings of any kind. It offers high strength, good wearing qualities and corrosion resistance. Its resistance to salt-water corrosion makes it particularly suitable for marine use. It is flexible to allow conformity to rounded edges and can be cut easily to adapt to any size or shape surface. The high-tack adhesive permits permanent adhesion to any clean, smooth, dry surface.

Fasson Products Co., 250 Chester St., Painesville, Ohio.

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UNIFORM  
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Exact quality control standards employed by Bird are your guarantee that every Bird Sapphire or Glass Jewel Bearing, or Complete Jewel Assembly or Cushion Jewel Assembly, is as specified. There's never a chance of inconsistency in dimensions, chemical and physical properties.

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Our engineering staff would be pleased to work with you on your special jewel bearing needs. Write for our free catalog with complete details on properties and uses of jewel bearings.

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1 SPRUCE ST., WALTHAM, MASS.

Serving industry with fine jewels since 1913

Circle 136 on Reader-Service Card

**Contact-Bond  
Adhesive  
Booth 560**

**376**

Contact-bond adhesives for industrial applications may be applied to components or bonded in advance of actual assembly operation. When component parts are to be bonded, only momentary pressure as achieved with a hammer or nip roll is required to effect a strong bond. Adhesives can be used in industrial applications for bonding sandwich panels, rubber weatherstrip, fabrics to metal, metal to metal, aluminum to plywood, nameplates, metal moldings and other applications. One high-strength contact-bond adhesive, designated as EC-1828, can be spray-applied in a relatively dry form. A momentary application of pressure, such as achieved with a pinch roll, will then immediately bond the two components together with a strong bond.

Minnesota Mining & Mfg. Co.,  
900 Bush Ave., St. Paul 6, Minn.

**'Mylar' Vinyl  
Laminates  
Booth 416**

**377**

Decorative "Mylar" vinyl is available in gold, chrome and copper-colored laminates. These self-adhesive materials come in a wide variety of embossed and unembossed patterns as well as textured surfaces. They are constructed of half-mil metallized "Mylar" film bonded to a vinyl film. The adhesive permits application to most any clean, smooth, dry surface. Tests show that the aggressive, pressure-sensitive adhesive actually holds tighter with time.

Fasson Products Co., 250 Chester  
St., Painesville, Ohio.



Circle 137 on Reader-Service Card



**For Your Power Drive • Design • Application or Replacement Maintenance**

# There's a **T-J** CYLINDER That Can Assure Accurate Efficient Operation

Only T-J's complete line can assure you a cylinder of either air or hydraulic application—with practically limitless design specifications for bore, stroke, pressure range and even delivery requirement. From the time-tested,

standard tie-rod air and hydraulic, to the exclusive T-J Spacemaker, and including the recently introduced Squair Head, T-J cylinders give you more features for efficient, long-lasting operation. Write today!

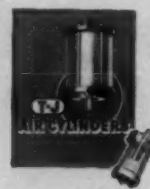
**Plus**  
**THE ONLY  
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**H-47** for  
standard tie-rod  
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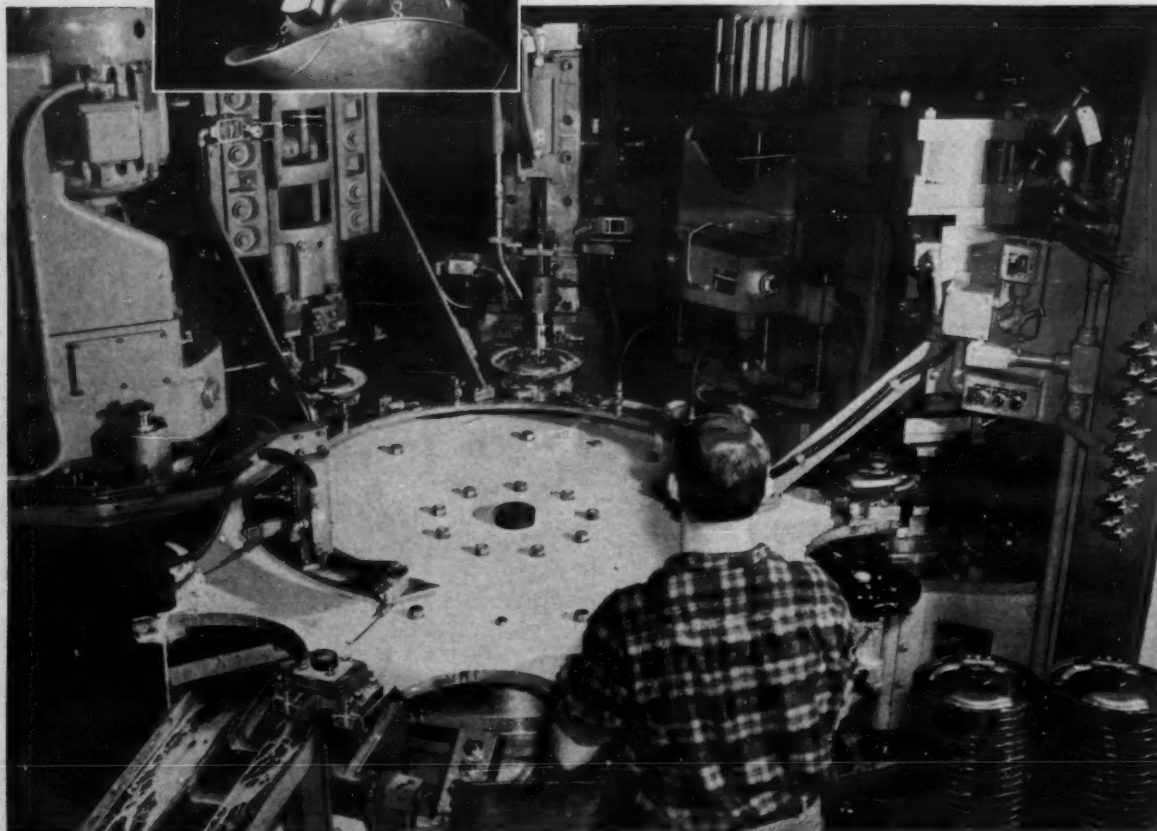
**HSM5-58-4**  
for the High-  
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**THE TOMKINS • JOHNSON CO.** JACKSON, MICH.  
CYLINDERS • MILLING CUTTERS • RIVETERS and CLINCHERS



MOTORS  
BY THE  
POUND?

*You're buying motors by the pound  
when price is the only consideration*



## Today's machine tools can't afford motors selected on the basis of price alone

Modern machine tools are designed to manufacture products of great precision at the lowest possible cost. But a machine tool is only as productive as the electric motors that drive it. Motors purchased on the basis of price alone often fail to give their users the greatest value in terms of useful service life.

The selection of the right motor to power your products requires not only specification of type, rating and operating characteristics, but consideration of such factors as uniform, troublefree performance, dependable long-life operation, the reputation of the manufacturer, and

his ability to provide immediate repair parts and service—when and where they're needed. Wagner® motors have earned their reputation for proven dependability in their specific applications.

Next time you buy motors, check beyond the purchase price. Make sure that you get all the performance you need—with motors that will do the job.

Wagner motors have been getting the job done for more than 65 years. Your Wagner Sales Engineer will be glad to show you why. Call him for an analysis of your next motor application, be it for plant or product.

*Branches and Distributors in all Principal Cities*

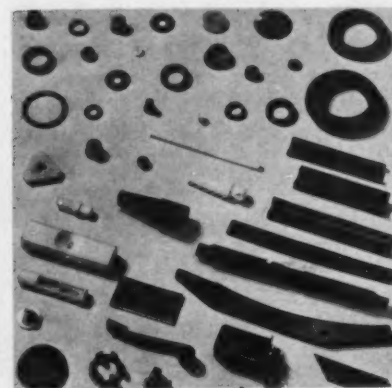
**Wagner Electric Corporation**

6487 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

Circle 138 on Reader-Service Card for more information

## MATERIALS

**Custom Fabrications 378**  
**Booth 146**



A variety of shapes and fabricated parts can be manufactured to customer specification in "Rulon" (reinforced TFE) and "Teflon". Parts can be suited to applications requiring chemical inertness, low friction, high compressive strength, wide temperature tolerance, lube-free operation—all characteristics of these modern fluorocarbon materials. A reinforced TFE spray is also available in aerosol cans. The spray offers a fast, simple way to obtain low-friction, slick surfaces for wood, metal, leather and plastics. It is useful as a lubricant for belts, gaskets, gears, cable and an antistick agent for blenders, tanks, chutes and conveyors.

Dixon Corp., Bristol, R. I.

**Prefinished Metals 379**  
**Booth 1042**

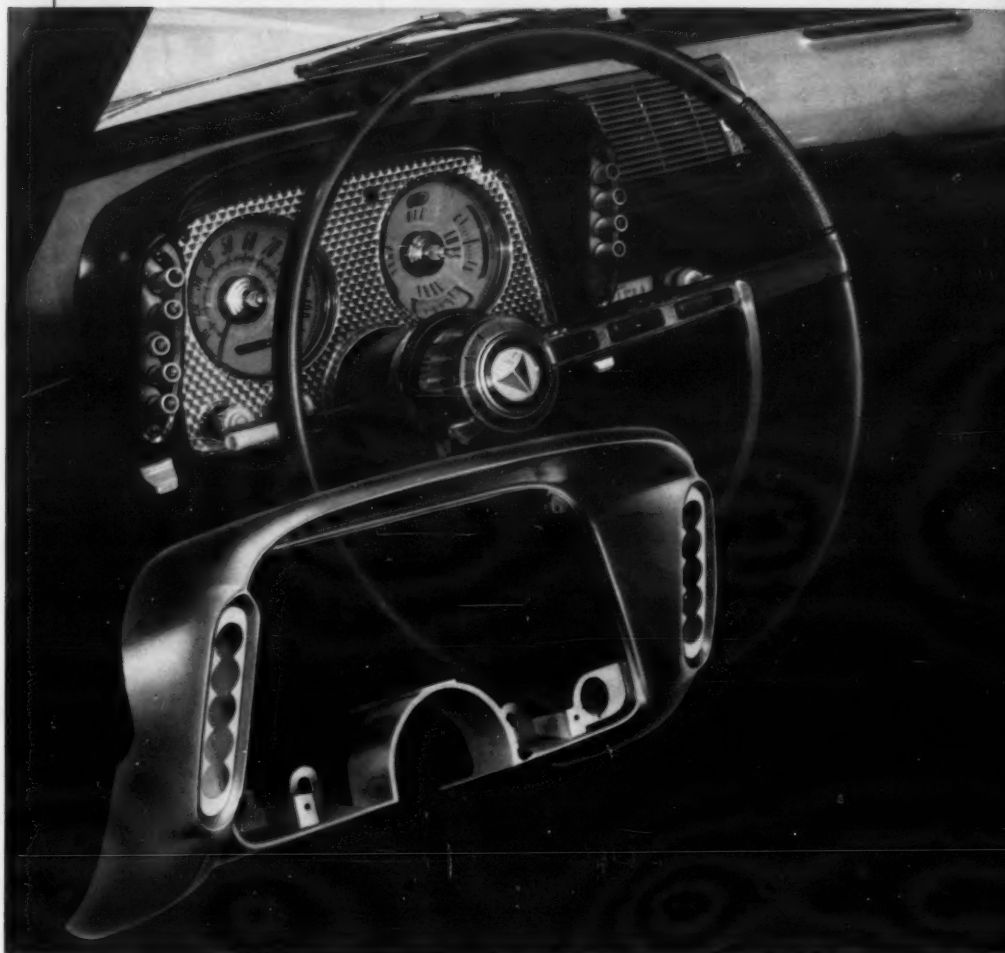
This line of preplated and prefinished metals includes materials of steel, zinc, brass, copper and aluminum, in finishes of copper, brass, nickel and chromium. Materials are available in strips, sheets, blanks and long continuous coils in gages from 0.010 to and including 0.062. Also available is a semirigid vinyl sheeting in prints, colors and textures that is permanently fused to basic materials of steel, aluminum, electrogalvanized steel and aluminized sheet.

American Nickeloid Co., Peru, Ill.

Circle 139 on Reader-Service Card

*working with*  
**Du Pont Delrin**

*one of Du Pont's versatile  
engineering materials*



**New  
instrument  
housing of  
DELTRIN®**

**cuts weight 80%...simplifies assembly**

In designing a compact automobile, weight reduction stands out among the objectives—less weight means improved fuel economy and easier handling. That's one of the reasons why Chrysler Corporation's 1961 Valiant has a one-piece instrument housing molded of Du Pont DELTRIN acetal resin. At no sacrifice in performance, the use of DELTRIN cuts the weight of the instrument housing by approximately 80%—from nine pounds in die-cast zinc to two pounds in DELTRIN. This reduction not only pays off in lower over-all weight, but also eases handling on the assembly line.

The attractively styled housings of DELTRIN have proved their durability through extensive road and laboratory tests. DELTRIN offers strength in thin sections, even at elevated temperatures... remains dimensionally stable under varying conditions of humidity. Mounting of the housing is simplified because molded-in bosses accept self-tapping studs.

On the following page you will find more examples of the product improvements and savings in manufacturing and assembly costs made possible by DELTRIN acetal resins in a variety of diverse fields.



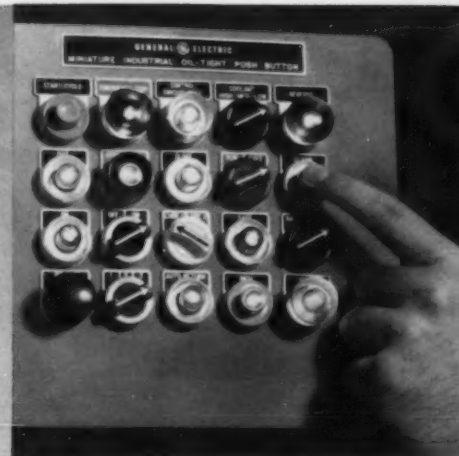
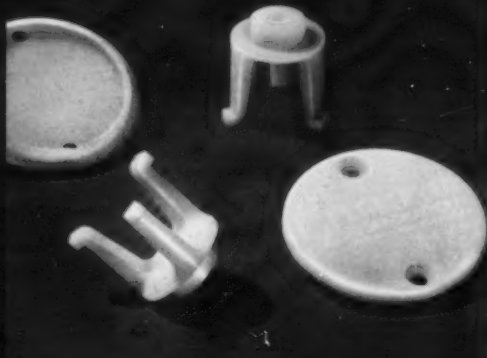
REG. U.S. PAT. OFF.  
BETTER THINGS FOR BETTER LIVING  
THROUGH CHEMISTRY



working with

**Du Pont Delrin®**

one of Du Pont's versatile  
engineering materials



The manufacturer of these valve components for check valves in water or gasoline pumping systems reports: "Severe testing proves that the disc retainer guide made of DELRIN is practically indestructible." Use of DELRIN instead of brass also prevents mineral build-up . . . eliminates the cause of valve sticking and faulty seating. (Molded by Holman Mfg. Co., for a division of Flomatic Corp., both of Hoosick Falls, N. Y.)

Shock absorber designed to eliminate water-hammer noises in residences has outer shell molded of tough Du Pont DELRIN. Reason for this choice: the shell of DELRIN is highly resistant to damage from residential shock pressures, exterior corrosion from most chemicals and water at 180°F. ("Genie" is molded for Josam Mfg. Company, Michigan, Indiana, by Stelrema Corp. of Gary, Indiana.)

A complete line of miniature oil-tight push buttons (colored buttons, rings and knobs) molded of Du Pont DELRIN to help provide easy identification. Designed for the toughest applications, these push buttons rely on the toughness, color variety, durability and wear resistance of Du Pont DELRIN acetal resin. (Manufactured by General Purpose Control Department of General Electric Co., Bloomington, Illinois.)

## Parts of DELRIN® offer rugged, dependable performance under tough conditions

The strength, durability and dimensional stability of DELRIN acetal resin are particularly important when the part in question is subject to severe environmental conditions, such as high temperatures, moisture, solvent and many corrosive chemicals. In use after use, designers are continuing to find that DELRIN provides parts that will perform under these adverse conditions . . . plus substantial economies in manufacture and assembly. How about DELRIN for your product? Mail the coupon for further information.

POLYCHEMICALS  
DEPARTMENT



BETTER THINGS FOR BETTER LIVING  
... THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)  
Department I, Room 2507-D  
Nemours Building, Wilmington 98, Delaware

I am interested in evaluating DELRIN for the following use:

Name \_\_\_\_\_

Company \_\_\_\_\_ Position \_\_\_\_\_

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A  
B  
C  
D

**DELRIN®** acetal resins

one of Du Pont's versatile engineering materials

**Alathon®** • **Zytel®** • **Lucite®**

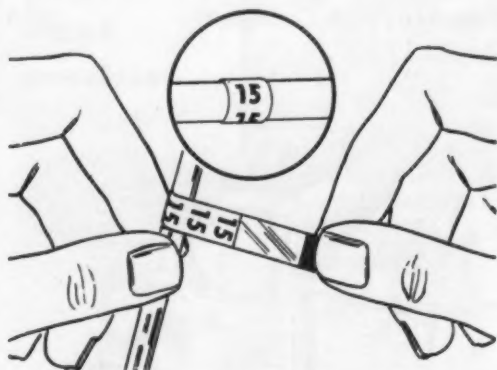
polyethylene resins

nylon resins

acrylic resins

**Self-Laminating  
Wire Markers  
Booth 142**

**380**



A new system of marking wires with "E-Z-Code" self-laminating wire markers is offered from stock in several size lengths to resist conventional oils, greases, chemicals, fluids and other foreign matter. Each self-adhering marker is partly a precoded marker and partly transparent with a self-contained lamination extension. When applying a coded marker around wire, the remaining protective clear portion wraps around itself, causing it to laminate permanently over coded area, protecting itself. Markers are suitable for use in motor repairs, machine-tool wire identification, transformer leads, outdoor equipment, switches and signals, railroad equipment and engines. Free working samples are available.

Westline Products Div. of Western Lithograph Co., 688 E. 2nd St., Los Angeles 54, Calif.

**Laminated Plastics  
Booth 421**

**381**

These laminates are both glass-based grades; one is an improved melamine resin type and the other is a new flame-retardant epoxy resin material for printed circuits. The melamine-glass laminate is designated "Phenolite" Grade G-5-818. It has improved electrical and mechanical properties over standard laminates in NEMA G-5 type. It will meet all requirements of the proposed new military specification MIL-P-15037 for type GME. Printed-circuit material, grade G-10-866, is a flame-retardant epoxy-fiberglass laminate. This grade offers good dimensional stability, chemical resistance and electrical properties of conventional G-10 laminates plus the advantage of flame retardancy. This flame-retardant feature is of prime interest to users and fabricators of printed circuits for computers and military apparatus.

National Vulcanized Fibre Co., Maryland Ave. & Beech St., Wilmington 99, Del.



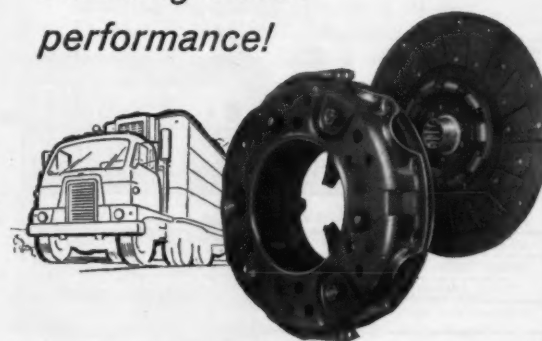
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**TORTURE-TEST PITS burst clutches to bits**

Rockford Clutch reliability is due to the varied and frequent quality checks made at every production step. At specified intervals, clutches are removed from the production line and lowered into torture-test pits. Severe centrifugal tests spin these clutches to destruction! Each tested clutch, however, must withstand predetermined ultra-high speeds for specified time limits . . . another quality control check made to assure you of Rockford Clutch dependability. Rockford offers you an extremely wide range of proven power controls. Write today for illustrated brochure.

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enduring clutch  
performance!*



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DIVISION  
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WARNER

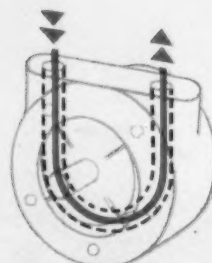
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# GAST

## AIR MOTORS COMPRESSORS VACUUM PUMPS

Gast offers you specialized experience in Air Motors, Air Compressors and Vacuum Pumps . . . for original equipment or plant use. The types and sizes shown, with selected accessories, will solve many application problems. All models feature rotary sliding-vane design for quiet, pulseless, positive air displacement. Vanes take up their own wear, maintaining high efficiency.

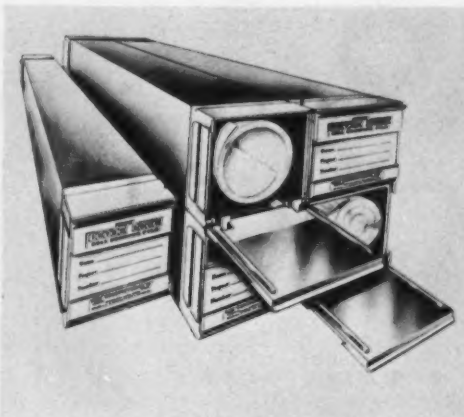


ALL GAST UNITS FEATURE THIS SIMPLE, DEPENDABLE ROTARY-VANE DESIGN

## EQUIPMENT

### File Storage Cabinet Booth 1238

384



A storage system, that protects engineering drawings and blueprints from needless wear through excessive handling, provides simplified filing and accessibility. Each file is comprised of a fiber-board tube which is housed in a square fiber-board box. A metal end, which interlocks, eliminates the need for supporting racks or frames. They can be stacked from floor to ceiling, taking up every inch of unused space. Drawings can be rolled and stored neatly in tubes, either individually or in related groups. For maximum storage, tubes will take 30 drawings. Metal ends also provide a convenient space for indexing. Drawings can be properly labeled and easily located. This eliminates costly and complicated card-index and cross-index systems. Special "out" cards indicate material removed from file.

Pack Mfg. Co., 55 W. First N., Logan, Utah.

### Pressure-Sensitive Tape Dispenser Booth 212

385

"Strap-It 4W" is a portable, hand-operated dispenser which applies, wipes down and cuts pressure-sensitive tape, including strapping tapes, up to two inches wide in one operation. The unit is balanced and light in weight for minimum worker fatigue. The device can be used on production lines, holding single rolls up to 120 yd long. After tape is cut, a free end remains as a self starter for the next application.

PERMACEL, New Brunswick, N. J.

COMPRESSED AIR MOTORS				
Model	Rpm.	Hp. At 60 Psig.	At 90 Psig.	Wt. Lbs.
1 AM	2,000	0.11	0.13	1 1/2
	5,000	0.21	0.30	
2 AM	1,000	0.22	0.35	5 1/2
	2,000	0.40	0.57	
4 AM	1,000	0.48	0.73	8
	2,000	0.78	1.10	
6 AM	1,000	0.80	1.30	17
	2,000	1.30	2.00	
8 AM	1,000	1.60	2.40	25
	2,000	2.80	4.20	
16 AM	1,000	2.70	4.20	65
	2,000	4.20	6.80	

BLACK = LUBRICATED RED = OIL-LESS MODELS

AIR COMPRESSORS										
			Rec. Max. Press. Psig.							
Model	Model No.	Hp.	Cfm.	Cont. Oper.		Intermittent		Net Wt.* Lbs.		
Integral (Motor Compressor)	0406	1/12	0.57	0.5	15	10	20	15	16	16
	0211	1/4	1.3	1.1	15	10	25	15	22	22
	0321	1/2	2.3		20		25	25		
	0521	3/4	3.8		15		20		26	
Light-Duty	0240	1/4	1.9	1.9	10	10	20	10	8	7
	0440	1/2	4.0	4.0	10	10	20	10	10	9
	0740	3/4	5.9	5.9	10	10	12	10	10	9
	1550	3/4	10.5	10.5	10	10 1/2	15	10	29	26
	3040	2	30.0	24.0	10	10	15	10	68	60
		1 1/2								
Heavy-Duty Fan-Cooled	0465	1/2	4.0		25	30			18	
	0765	3/4	5.9		10	15	18			
	1065	1	8.3		25	30			33	
	2065	1 1/2	17.0		20	25			52	
	2565	2	21.0		15	20			51	
	4565	3	45.0		15	20			92	

\*Weight without base or motor, except integral models.

VACUUM PUMPS											
Model	Model No.	Hp.	Cfm.	Rec. Max. Vac. "Hg						Net Wt. Lbs.	
				Cont. Oper.	Intermittent						
Integral (Motor Pump)	0406	1/12	1/12	0.57	0.5	15	10	25	20	16	16
	0211	1/4	1/4	1.3	1.1	15	10	27	20	22	22
	0321	1/2	1/2	2.3		28				27	27
	0521	3/4	3/4	3.8		28				28	28
Light-Duty	0240	1/4	1/4	1.9	1.9	15	20	26	24	9	10
	0440	1/2	1/2	4.0	4.0	15	20	26	24	11	12
	0740	3/4	3/4	5.9	5.9	10	20	26	24	11	12
	1550	1 1/2	1 1/2	10.5	10.5	15	20	25	24	29	30
	3040	1 1/2	1 1/2	30.0	24.0	15	20	27	25	68	66
Heavy-Duty Fan-Cooled	0465	1/2	1/2	4.0		28				18	
	0765	1/2	1/2	5.9		28				18	
	1065	1	1	8.3		28				33	
	2065	1 1/2	1 1/2	17.0		28				54	
	2565	2	2	21.0		28				53	
	4565	3	3	50.0		20		28		92	

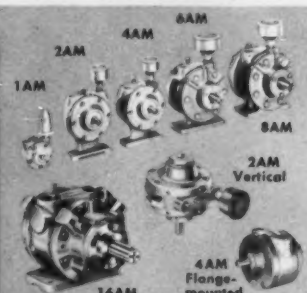
\*Weight without base or motor, except integral models.

MINIATURE OIL-LESS • COMPRESSOR • VACUUM				
Model	Wt. Lbs.	Hp.	Type Drive	Pump Rpm.
0330	3.2	1/40	direct	3450
0630	9.2	1/12	direct	3450
1030	9.2	1/12	direct	3450

\*with base and motor

### 1/20 TO 7 H.P.

**GAST AIR MOTORS** are explosion-proof and variable in speed. Built with either right or left-hand rotation—also in reversible models. They are amazingly compact, light in weight for h.p. delivered and low in cost. They'll start in any position . . . can't burn out from overloads or stalling. Rotor vanes take up their own wear, maintaining "like-new" efficiency. Offered with foot (base) or flange-type mounting . . . and for horizontal or vertical position.

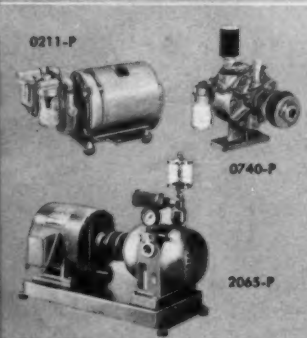


### .6 TO 45 C.F.M.

**INTEGRAL MOTOR-PUMPS** — Compact, light weight, efficient "packaged" units. Compressor rotor mounted on motor shaft. Pulseless air delivery.

**LIGHT DUTY** — For intermittent service. Positive displacement. Resemble heavy-duty models, less fans or deep cooling fins (not needed for brief operating periods). Simpler lubricator.

**HEAVY DUTY** — Fan-cooled for continuous operation. Rotary design — maximum air per lb., per h.p. Automatic lubricator has self shut-off when unit stops.



### .6 TO 50 C.F.M.

**INTEGRAL MOTOR-PUMPS** — Compact, light weight units save mounting cost and time. Excellent for portable equipment. Rotor mounted on motor shaft.

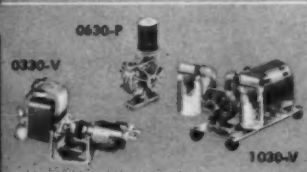
**LIGHT DUTY** — For intermittent service. Quick pick-up, trouble-free performance. Resemble heavy-duty models, less fans or deep cooling fins. Simpler oiler.

**HEAVY DUTY** — Forced air fan-cooled for continuous service, trouble free dependability. Deep cooling fins. Lubricator has built-in automatic shut-off.



### .3 TO 1 C.F.M.

**MINIATURE OIL-LESS PUMPS** — (larger oil-less models shown in red above.) 3 typical models shown here. Quality rotary sliding-vane construction. Other motors available: 1/25 & 1/20 h.p.



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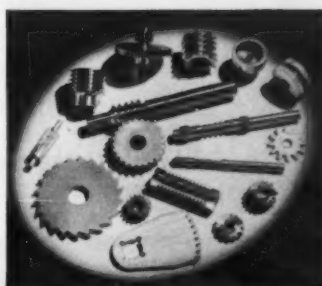
**GAST MANUFACTURING CORP.**  
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**NEW! Teflon® Plug Valves**

**\*Will never stick** — self-lubricating for a lifetime of smooth, easy operation at temperatures from —320°F. to 500°F.

**\*Chemical resistant** — completely resistant to nearly all chemicals, gases and solvents.

**\*Wear resistant** — Teflon plug lubricates the valve body. There is no fretting and galling and virtually no wear.

**\*Exceptionally well made** — individually hand lapped for a precision fit. 250 lb. service. Each valve air tested under water before shipment.

**\*Sizes and materials** — available with 2-3/4 or 5-way drillings. 1/8" to 1/2" IPS sizes available. Materials: brass, stainless steel, aluminum, steel, monel, etc.

Write for Bulletin SM462

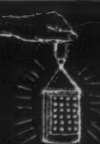
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DESIGN NEWS — MAY 8, 1961



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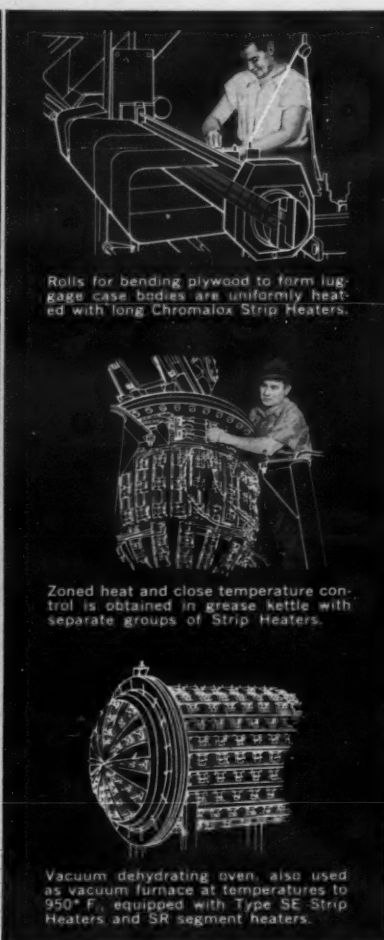


## CHROMALOX ELECTRIC STRIP HEATERS

Versatile, dependable, uniform heat  
for your product or processing needs



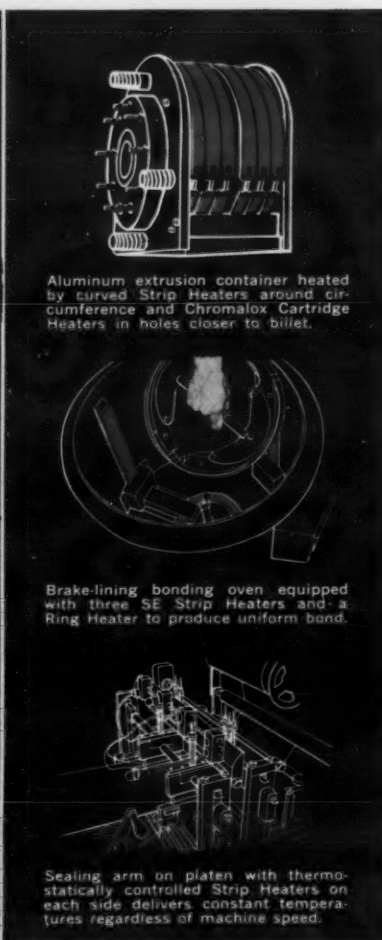
Chromalox Strip Heaters, sheathed in iron, chrome steel and Monel, come in sizes and types for every need. 4" to 96" lengths, 1" to 2½" widths. Also available in full rings and segments.



Rolls for bending plywood to form log-gage case bodies are uniformly heated with long Chromalox Strip Heaters.

Zoned heat and close temperature control is obtained in grease kettle with separate groups of Strip Heaters.

Vacuum dehydrating oven, also used as vacuum furnace at temperatures to 950° F., equipped with Type SE Strip Heaters and SR segment heaters.



Aluminum extrusion container heated by curved Strip Heaters around circumference and Chromalox Cartridge Heaters in holes closer to billet.

Brake-lining bonding oven equipped with three SE Strip Heaters and a Ring Heater to produce uniform bond.

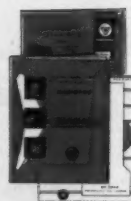
Sealing arm on platen with thermostatically controlled Strip Heaters on each side delivers constant temperatures regardless of machine speed.

Compact, metal-sheathed Chromalox Strip Heaters assure accurate temperatures, dependable around-the-clock service anywhere heat is needed for product or process. It is by far the most versatile built-in heat source available today. Easy to install—Chromalox Strip Heaters produce uniform and accurate temperatures with automatic or manual controls.

Low initial cost, low installation costs and low operating costs are among the many other advantages of using Chromalox Strip Heaters for heating tanks, platens, ovens, molds, moving parts, and similar uses. Over 500 standard sizes, shapes, ratings and terminal arrangements available immediately from stock. Get the full details now.

### GET THE FACTS

Write for Industrial Processing Catalog 60, Comfort Heating Catalog F-975D, Infrared Catalog G-62.



WI-10

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## EQUIPMENT

### Liquid Leak Detector Booth 209

386

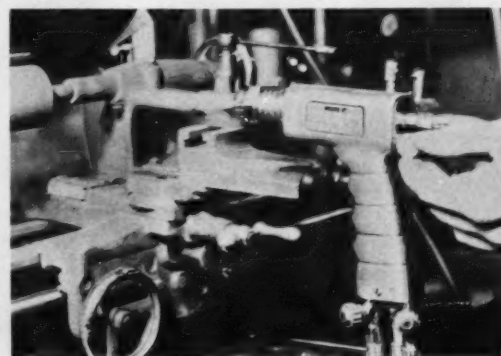


This device has a fine bubbling action that detects leaks in pressurized air or gas lines. A thin solid stream of the liquid is applied to test each connection. Bubbles form immediately if a leak is present. The solid-stream method of application avoids bubble formation from spraying. The device will detect leaks at the bottom of connections in vertical runs where gravity tends to remove testing fluid. Detecting device is available in eight-oz polyethylene squeeze bottle with a ½-inch tubing which is adjustable from ½ to 12 inches in length.

Nuclear Products Co., 15636 Saranac Rd., Cleveland 10, Ohio.

### Spray Welding Gun Booth 1234

387

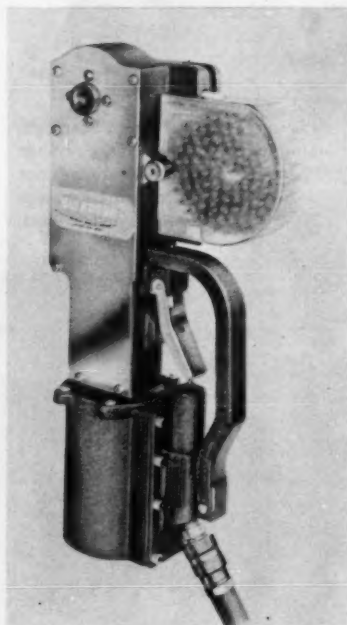


This unit is a medium-capacity, high-efficiency design for application of "Sprayweld" powders to hard-surface a wide variety of metals and alloys. It also is suited for flame-spray metallizing with a range of materials.

Wall Colmonoy Corp., Colmonoy Div., 19345 John R. St., Detroit 3, Mich.

**Portable Pneumatic  
Crimping Tool 388  
Booth 720**

Shown is the 10761 portable pneumatic crimping tool with automatic contact feed for crimping removable pin and socket contacts

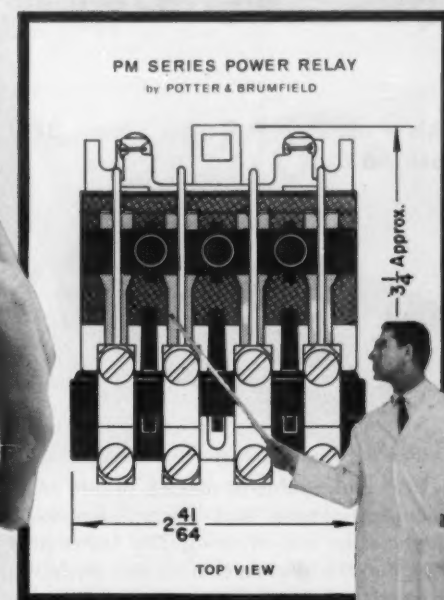
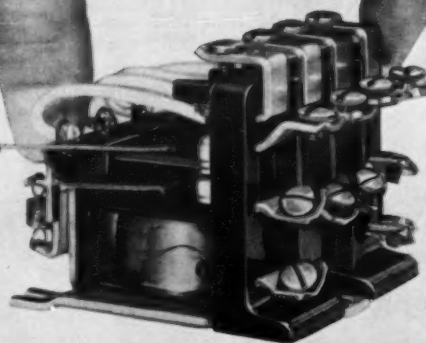


used in electrical connectors. It crimps MS-3190 No. 20a, 16 and 12 contacts; and MS-24254 and MS-24255 No. 20, 16 and 12 contacts. The tool is adaptable to other contact designs, both commercial and military. Device produces a crimp equivalent to a Class I configuration of MIL-T-22520 and crimped joints meet the performance requirements of MIL-T-22520. The tool crimps up to 102 contacts with a single loading. "See-through" contact magazines make it easy to set up and operate tool. Contact carrier strips are color-coded for contact size.

Buchanan Electrical Products Corp., Hillside, N. J.



Circle 149 on Reader-Service Card



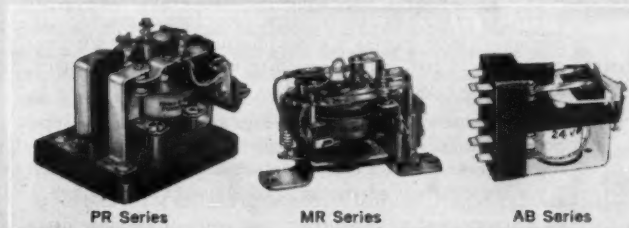
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Save panel space! This new 4-pole relay is only  $\frac{1}{4}$ " wider than our PR Series, America's most popular 2-pole power relay! Yet, it is engineered for reliable heavy-duty switching . . . and you can confidently expect 10 million mechanical operations.

PM Series relays are rated at 16 amperes (or 1 H.P.) at 115 volts, 50/60 cycles resistive . . . and special relays can be supplied for loads up to 25 amperes, at 220 volts, 50/60 cycles resistive. Heavy screw terminals are arranged for fast, easy hook up. An adapter plate is available for mounting PM relays in the same location used for 2-pole relays.

For full information, write today or call your nearest P&B representative.



A whole family of power relays for a wide range of applications carry the P&B symbol of quality. Call P&B first for all your power relay requirements.

### PM ENGINEERING DATA

#### GENERAL:

**Description:** Heavy-duty AC power relay.  
**Insulating Material:** Molded phenolic.  
**Insulation Resistance:** 100 megohms minimum.  
**Mechanical Life:** 10 million operations minimum.  
**Contact Life:** 100,000 operations minimum at rated load.  
**Breakdown Voltage:** 2,000 volts rms minimum between all elements and ground.  
**Ambient Temperature:** -55°C to +55°C.  
**Weight:** Approximately 14 ozs.  
**Pull-In:** 78% of nominal voltage.  
**Terminals:** Heavy-duty screw type with No. 8-32 BH screw.

#### CONTACTS:

**Arrangements:** 4PDT or 4PST—normally open.  
**Material:**  $\frac{1}{4}$ " dia. silver-cadmium-oxide.  
**Rating:** 16 amps @ 115 volts, 50/60 cps resistive.  
8 amps @ 220 volts, 50/60 cps resistive.  
1 H.P. per moveable, 115 or 220 volts AC single phase.  
25 amps @ 220 volts, 50/60 cps resistive available on special order.

#### COILS:

**Voltage:** 6 to 230 volts AC 50/60 cycles.  
**Power:** 14 volt-amps average at nominal voltage.  
**Duty:** Continuous.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONICS PARTS DISTRIBUTORS



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DIVISION OF AMERICAN MACHINE & FOUNDRY COMPANY

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IN CANADA: POTTER & BRUMFIELD, DIVISION OF AMF CANADA LIMITED, GUELPH, ONTARIO



## EQUIPMENT

### Push-Pull Force Gage Booth 863

389



This device is capable of making in-line measurement of tension and compression loads from the same end or head. The instrument has a split-scale dial indicator, and push and pull forces may be read directly from the appropriate side of scale. The measuring device is available from 0-10 to 0-250 lb and is accurate to one percent of full scale capacity.

Hunter Spring Co., Div. of American Machine & Metals, Inc., 1 Spring Ave., Lansdale, Pa.

### Controlled Filing System Booth 620

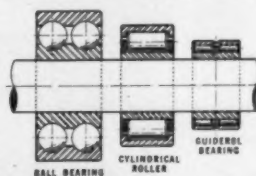
The "Moducor" system consists of four-, six- and eight-tube modules in 4-, 2½- and 1⅞-inch-dia tubes. All modules are of a standard width to permit stacking any size of modules for varying storage and activity requirements. Individual tubes are paper laminate, foil wrapped with steel ends for maximum strength, moisture, dust and smoke resistance. Tubes are anchored mechanically in a sturdy metal frame to prevent accidental tube removal while permitting easy insertion of a new tube without requiring tools, paste or glue. Hinged door is held in open or closed position by spring tension without latches or catches. All modules are reversible so that doors may swing up or down. Simple clip interlocking device assures safe, stable stacking to any practical height and assures both lateral and vertical stability. All modules are a uniform 18¾ inches wide and are offered in lengths varying in 6-inch increments from 24 to 60 inches. Module heights vary according to tube diameter—four-tube unit, 5½ inches high; six-tube unit, 3⅞ inches high, and eight-tube unit, 3-1/16 inches high.

Hamilton Mfg. Co., Two Rivers, Wis.

# McGILL®

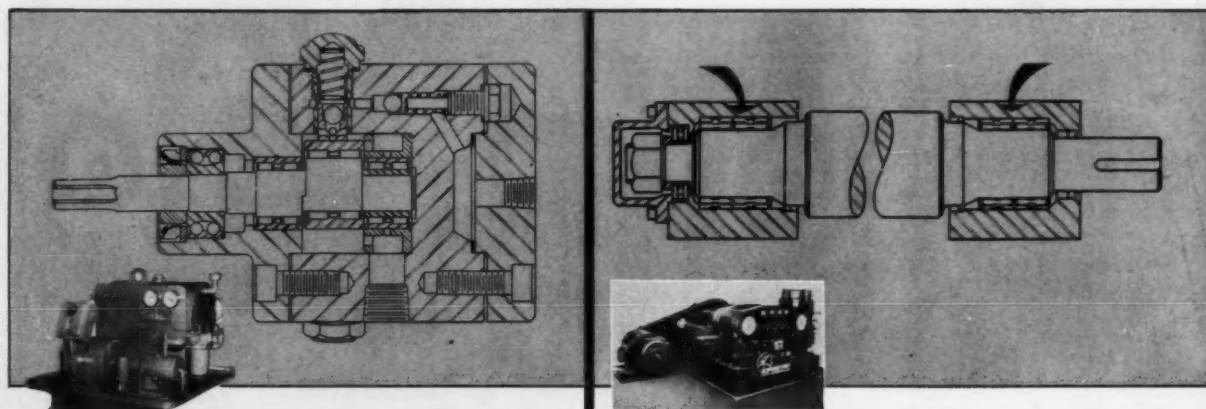
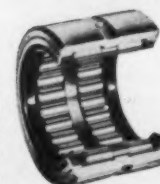
## GUIDEROL® bearings offer higher load

GUIDEROL bearings pack more high capacity performance into smaller radial space. Their construction features the extra capacity of a full complement needle bearing and effective roller control. Center guided rollers limit skewing and prevent binding under adverse conditions in either horizontal or vertical mountings. For a common 1" shaft, the GUIDEROL bearing has an O.D. of only 1½" with a capacity of 6310 lbs. Compared to a cylindrical type roller bearing, the GUIDEROL bearing requires ⅓" less housing space and offers 23% more capacity. A ball bearing for the same shaft uses almost an inch larger O.D. to carry 1500 lbs. less radial load. Space-saving GUIDEROL bearings simplify design and cut housing space requirements. Available with or without inner rings in shaft sizes from ⅜" to 9¼" with capacities ranging from 2880 lbs. to 128,670 lbs. (at 100 RPM).



**Sealed Guiderol Bearings Protect Performance Life and Cut Maintenance**

Pre-lubricated and sealed GUIDEROL bearings lock lubrication in and seal contamination out. Interchangeable dimensionally with GUIDEROL GR Series bearings, they cut maintenance in two ways. Bearings last longer and frequent re-lubrication is not required. 5 different seal combinations are available to fit specific mounting requirements.



### SIMPLEX ENGINEERING USES GUIDEROL BEARINGS IN HIGH PRESSURE HYDRAULIC PUMPS

The SECO "LA" Series pumps, shown in cross section above, are fixed displacement seven piston radial pumps, utilizing unique patented principles which enable them to generate pressures as high as 10,000 PSI without loss of mechanical efficiency. SECO pumps are manufactured by the SIMPLEX ENGINEERING COMPANY, a subsidiary of RACINE HYDRAULICS & MACHINERY, INC.

MCGILL GUIDEROL MT Series bearings are used as shaft support bearings, and center eccentric floating bearings in these and other series Simplex pumps.

SIMPLEX reports unusual success with heavier loads and most satisfactory bearing life through ten years of use of MCGILL bearings. They have helped to produce the strikingly long life for which these pumps have become famous.

### KANE AND ROACH LEVELER SHAFTS ROLL ON GUIDEROL BEARINGS

Kane and Roach depends on 26 matched pairs of GUIDEROL bearings to carry the leveling and flat straightening loads resulting from rolling alloy steels of 80,000 PSI yield. They are used on K & R No. 7 Levelers as roll neck bearings on the 11 power driven main leveler shafts and on the pair of adjustable pinch roll shafts that guide entry of alloy steel bars up to 1" thick by 8" wide.

Shown are the matched GUIDEROL bearings in their roll neck mountings. Driven through universal joints at 38 to 114 RPM, the power rollers, supported at each end by pressure lubricated GUIDEROL bearings, provide production speeds of 70 to 210 feet per minute.

Kane and Roach uses GUIDEROL bearings in many applications with complete assurance of extra capacity and dependable performance with minimum maintenance.

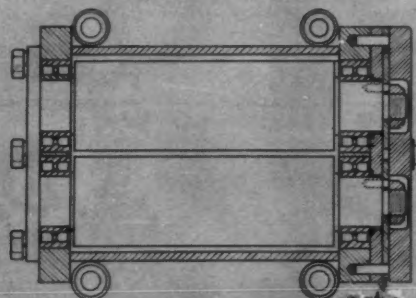
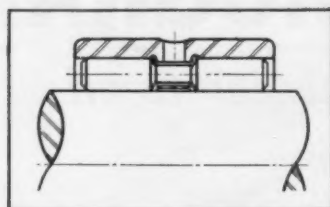


WRITE TODAY FOR FREE MCGILL BEARING CATALOG No. 52-A for complete data on MCGILL GUIDEROL, CAMROL, MULTIROL and CAGEROL BEARINGS.

## capacity in smaller radial space



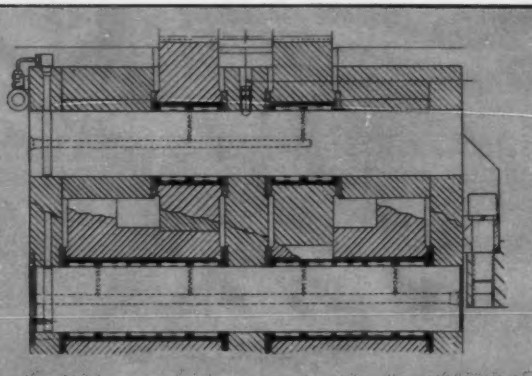
GUIDEROL BEARING  
Cutaway to show center guided  
roller principle



### GUIDEROL BEARINGS WITHSTAND VIBRATION IN LIMA ROADPACKER APPLICATION

GUIDEROL bearings support the off-balance rotors which produce vertical vibration in the six vibrator assemblies of each LIMA ROADPACKER machine. The drawing shows the position of 4 rotor support bearings. A gear motor drives the rotors which are one-half filled with lead to produce vibration for road compacting.

The user states that GUIDEROL bearings were selected because of high capacity in limited diameter and their ability to withstand extensive off-balance vibration. Possible end floating of the separable bearing fits the design very nicely. Performance is considered most satisfactory as the bearings easily resist the eccentric loading.



### GIDDINGS & LEWIS SKIN MILLING MACHINE APPLICATION REQUIRES GUIDEROL RIGIDITY — MINIMUM DEFLECTION

GUIDEROL BEARINGS, IN MATCHED SETS are used to mount the reduction gearing in the table drive gear box of each NUMERCOID tape controlled skin milling machine. The drawing shows a partial section of the table drive. GIDDINGS & LEWIS MACHINE TOOL CO. cites excellent performance of the GUIDEROL bearings. Guided rollers in this bearing have eliminated the problem of having the roller bind on the shaft if slight misalignment is present. The drive assembly mechanism reduces back lash by using a pre-loaded gear arrangement and matched bearings. The bearings are flooded with oil through the center of the shaft. Speeds are 1/30 to 460 RPM.

engineered electrical products



precision needle roller bearings

MULTIROL-GUIDEROL-CAMROL-CAGEROL

MCGILL MANUFACTURING CO., INC., Bearing Div.,  
203 N. Lafayette St., Valparaiso, Ind.

Circle 150 on Reader-Service Card for more information

### Protective Carry-File Booth 1131

391



This lightweight, compact and rugged unit is useful for those who use plans and prints on the job or in the field. Called the "Roll-Pack", it consists of four tubes mounted in a steel housing with a spring-latched door. Tubes are  $2\frac{3}{8}$  inches in dia and  $23\frac{1}{2}$  inches long. Housing, which is equipped with a convenient fold-away handle for carrying, measures  $12\frac{1}{2}$  inches wide,  $24\frac{1}{4}$  inches deep and  $4\frac{1}{2}$  inches high. It accommodates standard 24-inch plan width by practically any length. A 30-inch size is also available. The unit weighs only 8 lb and has the capacity for four complete sets of plans, prints, maps or drawings.

Plan Hold Corp., 5204 Chakemco St., South Gate, Calif.

### Lip Seal Rating Machine 392 Booth 412

"Sealrater" duplicates seal running conditions and is applicable to endurance, acceptance and performance testing of lip seals. Unit can simultaneously test two seals of different sizes up to 10 inches in dia and can duplicate operating conditions such as start and stop cycling, speed variations, oil temperature, and pressure and axial travel of seal on shaft. Test shaft can turn up to 6000 rpm (standard) or up to 10,000 rpm (optional). Test oil can be heated up to 325F without oxidation. Low-watt-density heating system uses six 750w heaters strapped on outside of oil chamber so that walls form a large heat-transfer surface. A 5-gpm pump circulates two gal of oil per minute past walls. The device uses 220/440v a-c, 60-cycle current; dimensions are 36 inches wide, 46 inches long and 42 inches high.

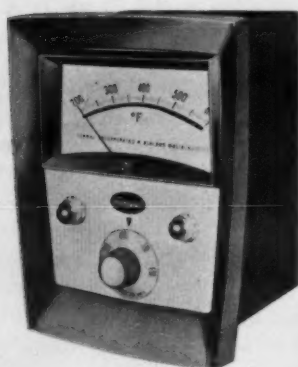
General Motors Research Laboratories, Warren, Mich.



## EQUIPMENT

### Temp-Indicating Controller 393 Booth 460

The Model 561 is an electronic temperature-indicating unit capable of controlling within 0.1F sensitivity. This instrument combines a transistorized control circuit and an independent indication circuit, all in one compact unit, offering a wide performance range of -50 to 600F, using thermistor sensing elements. A tiny thermistor bead is the heart of the temperature-sensing probe. Standard thermistor probes which are available include five standard ranges



between -50 to 600F, or celsius equivalent, with cartridge, hex-head, circular-head, flange-head and coupling-head mounting arrangements, and with probe lengths from 1½ to 10 inches in increments of one inch. The unit can be located up to several hundred feet from thermistor sensor without affecting control sensitivity and with only standard copper wire.

Fenwal, Inc., Pleasant St., Ashland, Mass.

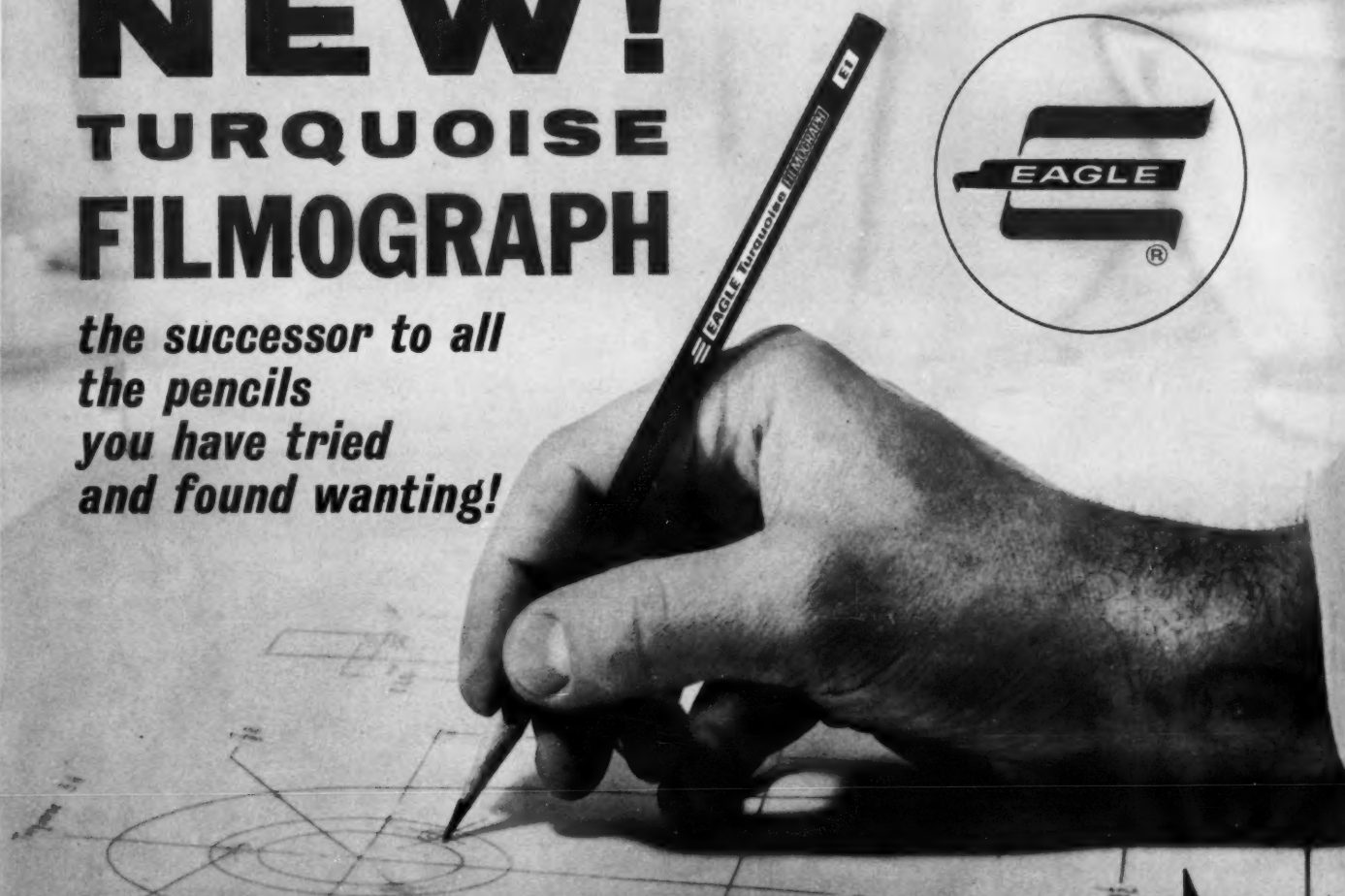


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# NEW! TURQUOISE FILMOGRAPH

*the successor to all  
the pencils  
you have tried  
and found wanting!*



AFTER FIVE YEARS OF EAGLE RESEARCH, new Turquoise FILMOGRAPH is the first pencil that makes all the advantages of coated film really useable!...gives you the sharpest, clearest reproduction you have ever experienced. Here's why:

- FILMOGRAPH lets you lay down a fully opaque, solid black line—uniform in thickness from start to finish—on any brand of drafting film you prefer.
- FILMOGRAPH will never feather or fuzz, or deposit powdery granules that blow all over your work and smudge it.
- FILMOGRAPH imparts a welcome new confidence to your hand with the feel of its smoother, finer point that stays sharp longer... never snaps under normal working pressure.

Send for FILMOGRAPH SCIENTIFIC TEST KIT

## FREE!

Contains new FILMOGRAPH Pencils, new Film Eraser, a sheet of coated drafting film, and 8 tests that let you check out FILMOGRAPH's superior performance in your own hand!



E1 EAGLE Turquoise FILMOGRAPH

Your dealer carries new Eagle Turquoise FILMOGRAPH pencils and leads in these 5 grades—soft to hard—E1, E2, E3, E4 and E5.

EAGLE PENCIL COMPANY, Headquarters: Danbury, Connecticut

LET YOUR PROFESSIONAL HAND  
**COMPARE**  
THE PERFORMANCE OF  
**FILMOGRAPH**  
TO ANY OTHER DRAFTING PENCIL!



**SLAMMING** single lines or solid shading... your own eyes will convince you that Filmograph's new black plastic lead makes blacker marks on any plastic film.



**SLAMMING** double free-hand or draft with precision... you'll feel the finer gliding quality of Filmograph's perfected plastic lead. No squeak... no drag... no grit!



**POUNCE**... draw line after line, after line... Filmograph's non-dusting mark conserves lead, holds its sharp point much longer... spurs needless re-sharpening.



**POINT STRENGTH**... Sharpened your favorite way... held at your regular angle... Filmograph's stronger lead (and better bond of lead to wood) stands up under pressure.



**BRAND X**  
**FILMOGRAPH**  
**WHOLE LINE**... draw a full line clear across a sheet. Filmograph's sharp, clean, non-feathering line remains unchanged in thickness from end to end.



**NO SMOODING MARKS**... Rub the tip of your finger across a Filmograph line, and see for yourself! No smudge... no smear... no loss of definition!



**REPRODUCIBILITY**... Filmograph comes clean... leaves no "ghost line" on original or print, (especially with Eagle's new Film Eraser).



**SPARKY**... hold your drawing to light and you'll see Filmograph lines are really opaque... to bring you the sharpest reproduction.

Get your **FILMOGRAPH**  
**SCIENTIFIC TEST KIT**  
**FREE!**

Mail this coupon... NOW!

Eagle Pencil Company DEPT. D  
Danbury, Connecticut  
Please send me FREE, Filmograph Scientific Test Kit, including Filmograph pencils and a Film Eraser.

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

**Self-Adhesive  
File Hanger**  
Booth 1131

394



A single-sheet hanger made of heavy-duty press board has a self-adhesive strip already applied. Hanger is available in 18- and 36-inch sizes and is notched to fit the manufacturer's single-sheet rack. Hangers can be cut to any length with scissors. Almost any large sheet material can be filed vertically with use of this self-adhesive unit. Pre-drilled holes permit groups of hangers to be fastened together with ordinary 1/8-inch paper fasteners. Tracings and vellums can be reproduced with sheet hanger attached.

Plan Hold Corp., 5204 Chakemco St., South Gate, Calif.

**Lip Seal  
Inspection Machine**  
Booth 412

395

"Sealector" can automatically inspect 700 lip seals an hr for diameter and pressure by fitting seal over stub shafts and gaging flow of compressed air past seal lip. Each of three checking stations (high diameter, low diameter, pressure) is followed by a reject station which ejects seals failing the test. The number of rejected and accepted seals is totaled on dials on front of machine. The unit is 36 inches wide, 36 inches long and 60 inches high and weighs 1000 lb. It uses 110v a-c, 60-cycle current and 60 psi or more compressed air.

General Motors Research Laboratories, Warren, Mich.



Circle 151 on Reader-Service Card

**Typical profiles of Edgewater Rolled Steel Rings**



**HERE'S AN IDEA TO HELP REDUCE  
"profit squeeze"**

Buy rings that are formed so close to finished shape and dimensions that very little machining will be needed. The result—less labor, less scrap loss, lower overall cost.

Edgewater rings are forged from solid blocks of steel, and rolled by a powerful ring-rolling mill to required cross-section shapes (see typical profiles above). Close tolerances minimize finishing operations.

Edgewater rolled steel rings are of uniform quality, strong and tough. Diameters: from 5 to 145 inches. Send drawings for recommendations and prices.



INTERESTING description of the ring-rolling process is given in this brochure, **Edgewater Rolled Steel Rings**. We will be glad to send you a copy.



**EDGEWATER STEEL COMPANY**  
P. O. Box 478  
Pittsburgh 30, Pa.

Circle 153 on Reader-Service Card for more information



looking for  
new ideas  
in compact  
instrument drives?



put the  
**WARNER ACES\***  
on your design team...but not on your payroll

**\*Advanced Control Engineering Service**

Call on an expert clutch and brake design team that doesn't cost you a penny! Warner ACES . . . Advanced Control Engineering Service . . . working closely with your design engineers, brings you the experience gained in the application of Warner fractional hp electric brakes and clutches to hundreds of low-torque drives for instant actuation, smooth inching and jogging, high-speed cycling, synchronization, and automatic indexing. If your motion control problem involves data processing equipment, business machines, computers, aircraft components—almost any automatic device that requires fast automatic electromagnetic braking and clutching in a compact, lightweight package, here is the answer: Warner fractional hp electric brakes and clutches *plus* the extra advantage of Warner ACES on your design team. Phone or write Warner today for further details!

**WARNER ELECTRIC**

Warner Electric Brake & Clutch Co., Beloit, Wisconsin



**Warner fractional hp electric brakes and clutches**

provide high torque per size while controlling complex mechanical movements in limited space. Handling torque loads from 1.5 to 240 lb-in., these units are only 1" to 4" in diameter and just 7/8" to 2-1/2" long. For compact direct automatic actuation . . . investigate these versatile Warner electric brakes and clutches.



**EQUIPMENT**

**Precision Parts Cleaner  
Booth 102**

**396**

Engineered for use where large numbers of identical parts are to be cleaned on a continuous production basis, this assembly critically cleans sensitive switches, relays, choppers, semiconductors and other electrical and electronic precision components and assemblies at a rate of 600 units per hr. The turntable indexes automatically and introduces the parts to successive high-velocity spray-clean operations. A finely atomized spray of solvent, combined with filtered heated air, is directed against all areas. Oil, grease, silicone lubricants, rosin flux, fingerprints, lapping compounds and other forms of soluble and insoluble contamination are removed safely and economically. An integral ventilation system exhausts all vapors.

Cobehn Inc., 226 Passaic Ave., Caldwell, N. J.

**Adjustable Temp Control  
Booth 112**

**397**



This remote unit, Model 201, has been developed to control temperature of liquids, solids and gases. The basic instrument will control temperatures in two standard ranges—to change instrument range, it is only necessary to change "sensing unit". Sensor "R" allows a range from 0 to 450F and sensor "S" allows a range from 450 to 800F. Contact rating is 15 amps, SPST, at 115 or 230v a-c as desired. A slide switch on the instrument changes voltage rating to match supply. If heated mass and power input are properly balanced, accuracy to within  $\pm 2F$  is normal.

Electro-Flex Heat, Inc., 83 Woodbine St., Hartford 6, Conn.

Circle 154 on Reader-Service Card for more information

AMPCO... ONE-SOURCE SERVICE FROM RAW MATERIAL TO FINISHED PRODUCT

## What's so different about Ampco metal?

It's made to last—and does

Not by chance either! Ampco's "know-how" and controlled alloy-making procedures provide year-to-year uniformity and reliability.

Because Ampco metal is made to last—and does—it's ideal where severe load, wear, or corrosion problems must be solved.

Another difference—Ampco's one-source service. Whatever you need—sand, centrifugal, precision castings; shell moldings, extrusions, forgings, sheet and plate—Ampco has it. Write for Bulletin.

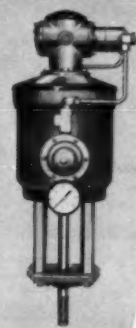
AMPCO METAL, INC.

Dept. 34E, Milwaukee 1, Wisconsin • West Coast Div. Huntington Park, Calif.

Southwest Div. Garland (Dallas County) Texas



Circle 155 on Reader-Service Card for more information



## SWITCH TO AUTOMATIC THROTTLING CONTROL FOR...

VALVES  
PROPORTIONING PUMPS  
VARIABLE SPEED DRIVES  
ETC.

Conoflow Series 50 Cylinder Conomotor is widely used on control valves, butterfly valves, pulp stock valves, proportioning pumps, motor driven speed changers, rheostats, etc. It provides automatic throttling control for these and many other types of processing equipment previously limited to manual operation. The Cylinder Conomotor is a powerful, fast, pneumatic actuator capable of matching today's high-performance instrument systems.

Bore diameters from 3" to 12.5". Travels to 24". Develops thrusts better than 12,000 lbs. in either direction. Holds loads to within .002" per inch of stem travel. Look into its potential for your equipment.

CC 103



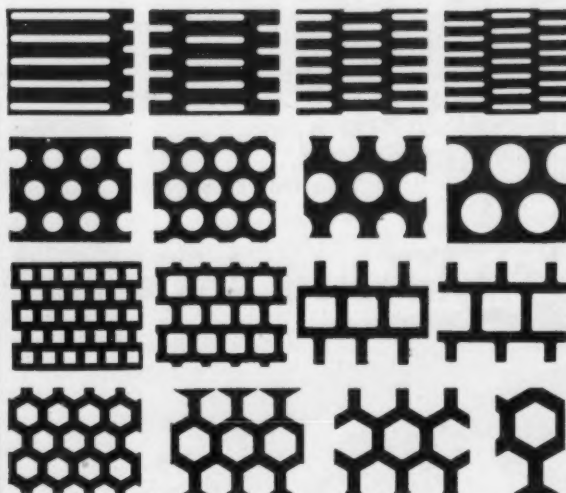
Write for Bulletin B-50.

CONOFLOW CORPORATION

FOREMOST IN FINAL CONTROL ELEMENTS  
2100 ARCH STREET, PHILADELPHIA 3, PA.

Circle 158 on Reader-Service Card for more information

DESIGN NEWS—MAY 8, 1961



put an extra plus in new products...

## HENDRICK perforated metal

Metalworking fabricators well know the importance of adding to product appearance while the product is in the design stage. That's why so many design engineers come to Hendrick for advice. Attractive Hendrick perforated metal is an invaluable material for manufacturers planning new design applications and product development. Hendrick perforated metals are available in a wide variety of patterns in every commercially rolled metal. Each can be supplied in a large number of sizes in plain or panel effects, with round, hexagon, square and squarround openings.

**HENDRICK**  
Manufacturing Co.  
Carbondale, Pa.

PERFORATED METAL • PERFORATED METAL SCREENS  
• WEDGE SLOT SCREENS • HENDRICK WEDGE WIRE  
SCREENS • ARCHITECTURAL GRILLES • MITCO OPEN  
STEEL FLOORING • SHUR-SITE TREADS • ARMORGRIDS  
• HYDRO DENAZERS

Circle 156 on Reader-Service Card for more information



## Fasten flat stock to tubing with RIVNUTS®

Simply drill the hole, insert RIVNUT, upset with heading tool. It's all done from the exterior of the work. RIVNUTS are the first blind rivets with internal threads—provide strong nutplates in many forms and types of materials. For RIVNUT Data Book write B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Dept. DN-5, Akron, Ohio.

**B.F. Goodrich Rivnuts**

Circle 159 on Reader-Service Card for more information

## NEEDED: EFFECTIVE VIBRATION ISOLATION AT TEMPERATURE EXTREMES

Vibration sensitive equipment often poses this problem: effective isolation against destructive shock and vibration—at temperature extremes.



## ANSWER: MB's NEW METAL ISO-DAMP™ MOUNT

Consists of two load-carrying springs mounted in opposed position, with built-in damper to restrict resonant build up. Requires no external cooling; effective from -100 F to +500 F.



## WHAT'S YOUR MOUNT PROBLEM?

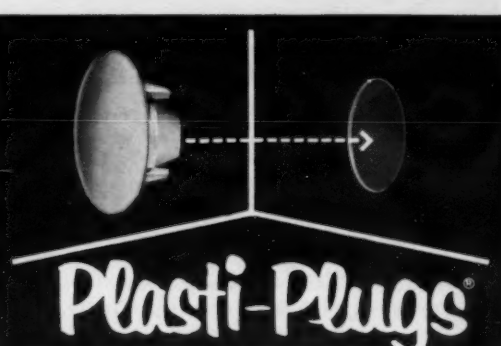
This new Iso-Damp can be adapted to meet your needs—or perhaps one of MB's other standard mounts may do the trick. Let MB help you with your problem. Write for information, ask for Bulletin 418-4.



**MB ELECTRONICS**

A DIVISION OF TEXTRON ELECTRONICS, INC.  
1071 State Street, New Haven 11, Conn.

Circle 157 on Reader-Service Card for more information



**Plasti-Plugs®**

## 45 STANDARD SIZES

FASTEX® Plasti-Plugs® snap-in type plastic plugs—are available for a wide range of applications, including:

- Ventilation Holes
- Access Holes
- Sealing Plugs
- Frictionless Glides
- Indicator Buttons
- Appliance Feet
- Spacer Buttons
- Conduit Holes

Available in several plastic materials, Plasti-Plugs can be color-matched to your product saving expensive rack painting, and they just snap in.

Write for FREE Plasti-Plug Folder.



**FASTEX**

195 Algonquin Road, Des Plaines, Illinois  
In Canada: SHAKEPROOF-FASTEX,  
Division of Canada Illinois Tools Ltd., Toronto, Ont.  
A DIVISION OF ILLINOIS TOOL WORKS

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## FABROID Self-Lubricating BEARINGS

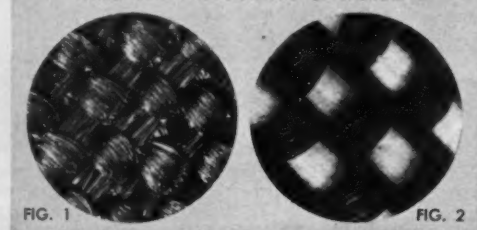


**REDUCE . . .**  
costs, wear, maintenance, and friction

**PROVIDE . . .**  
reliability, weight-saving, nearly-equal starting and running coefficients of friction

**ELIMINATE . . .**  
lubrication, fretting, brinelling, use of seals

MAGNIFIED PHOTOGRAPHS OF FABROID



### 10X-STRENGTH PROVIDES MAXIMUM LIFE FOR LOW-SPEED, HIGH-LOAD APPLICATIONS -

FABROID consists of two fused layers. The bearing layer (Fig. 1) is a weave of Teflon\* fibers interwoven on the back with a layer of phenolic-impregnated glass fibers of high tensile strength (light strands in Fig. 2).

Bonding the two layers under pressure and elevated temperature results in a dense lattice of self-lubricating Teflon fibers which have ten times the strength of other Teflon forms.

\*E. I. DuPont's Tetrafluorethylene

### FABROID solves these bearing problems . . .

- Lubrication and maintenance
- Extreme temperatures
- Tight space, weight conditions
- Abrading, galling, or corrosion
- Contamination
- Static Friction
- Shock and vibration

**There Is No Substitute For Fabroid Bearings**

U.S. Pat. No's. 2,804,886;  
2,835,521; 2,885,248

## MICRO-PRECISION DIVISION



Micromatic Hone Corporation  
1535 Grande Vista Ave.  
Los Angeles 23, California  
PHONE: Angeles 3-6142



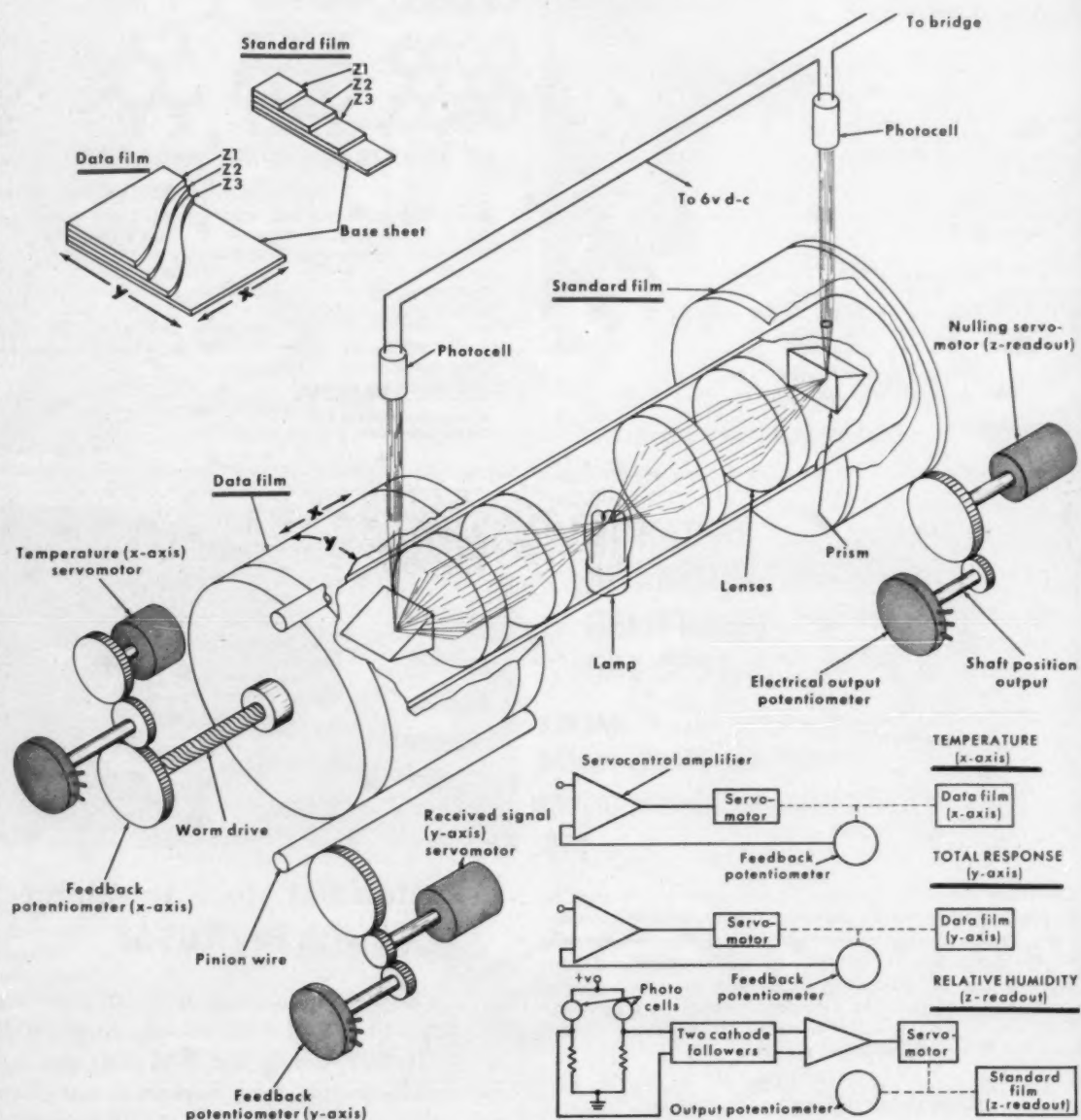
## DESIGN IDEAS

See this design idea in the DESIGN NEWS Booth No. 756

## MATERIALS

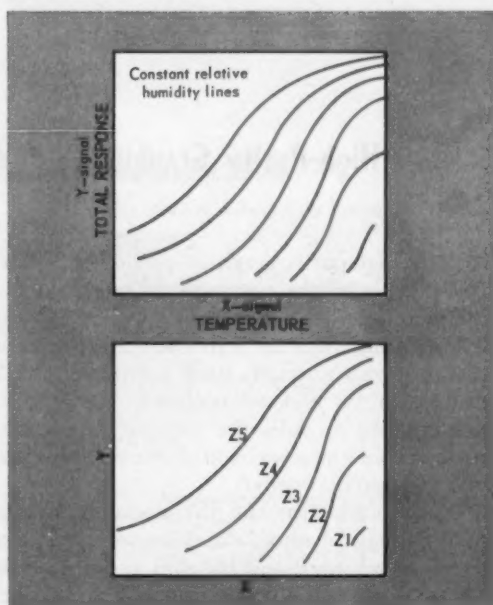
# 'Mylar' Stack Acts as Three-Dimensional Cam in Computer

Victor W. Wigotsky, Eastern Editor



DATA for "Mylar" contours are based on laboratory measurements of humidity elements (or on formulas such as  $Z = xy$  and  $Z = 2x + y$ ). Unit provides continuous readout of "Z" for changing "x" and "y". "Mylar" portion (data film) which represents specific humidity-element response (or mathematical function) is positioned along "x" axis (longi-

tudinal motion) and "y" axis (rotary motion) by introducing signals into respective inputs. Readout servo then positions standard film to balance photocell bridge. "Z", or true relative humidity, then appears as either voltage or shaft position. Output is smoothed by diffusing action of "Mylar" and by averaging action of photocell on beam of finite area.



SKETCHES illustrate similarity between problem and  $Z = f(xy)$  plot.

Stacked sheets of "Mylar" function as a three-dimensional cam in a meteorological computer. The sheets are cut to contours of constant relative-humidity lines. A null-seeking circuit then compares input signals against a standard to correct the information for temperature effects.

Two resistance elements are contained in a balloon-borne transmitter. One provides a signal representing temperature, which is used to longitudinally position the stacked "Mylar" sheets. The other signal represents "total response", or resistance, resulting from a combination of relative humidity and temperature. This signal causes rotation of the stack around the longitudinal axis. The simple analog computer then continuously reads out true relative humidity, automatically correcting, by comparison with a standard film, for the nonlinear resistance versus temperature characteristic of the sensing elements.

A three-dimensional cam was originally considered. A follower actuated by the cam then would operate a variable resistor to provide a signal for a servo-readout system. Instead, opacity of the stacked sheets of "Mylar" is used to represent constant relative humidity lines. This avoids difficulty and expense of fabricating a cam and is more flexible in event of a change of element characteristic. If a different sensing-element characteristic is required, it is simply a matter of tracing the contour on the "Mylar" and cutting it with scissors.

The " $Z = f(xy)$ " computer was designed by Barth Engineering and Mfg. Co., Inc., Meriden, Conn., for the Bureau of Naval Weapons.



## Now Fairmont creativity combines the advantages of two great metals



### FROM POTS AND PANS TO REFRIGERATED TRUCK BODIES

Cooking utensils which combine the excellent heat transfer properties of aluminum with the resistance to food acids of stainless steel. Or refrigerated transport which meets stainless regulations and also makes use of aluminum's light weight for bigger payloads. Or what have you? Fairmont Stainless Clad Aluminum will revolutionize a complete field of metal fabrication. Get in on the ground floor with Fairmont!

**THEY SAID IT WASN'T PRACTICAL.** But an intensive research program has been concluded, and Fairmont's new Stainless Clad Aluminum is now being rolled on a production basis, via patented methods providing a perfect molecular bond.

By successfully combining the ductility, light weight and high conductivity of aluminum with the strength, corrosion resistance and lustrous beauty of the stainless steel, Fairmont has opened doors wide to a thousand and one product improvements leading to more sales and new products by fabricators of all kinds.

Initially, Fairmont Stainless Clad Aluminum is being produced in flat sheet and flat circles or blanks. Other sheet forms will be made available in the not too distant future. For fabricators who know it pays to plan ahead, NOW is the time to call in a Fairmont representative for detailed facts, figures, application ideas.

## FAIRMONT ALUMINUM COMPANY

SUBSIDIARY OF CERRO CORPORATION

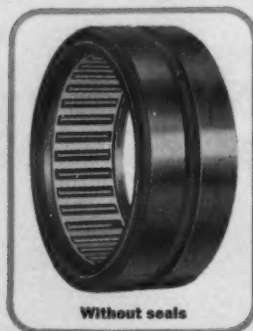
Sales Offices in Principal Cities

FAIRMONT • WEST VIRGINIA  
FAIRMONT 3010 • CABLE ADDRESS: FARMON

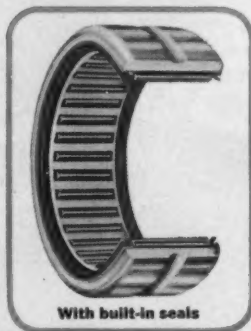
Circle 162 on Reader-Service Card for more information



# ORANGE ROLLER BEARINGS



Without seals



With built-in seals

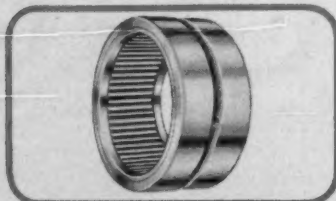
## ORANGE Cage Type NEEDLE BEARINGS

Precision needle rollers are permanently aligned in pockets of anti-friction cage—resist skewing while running in vertical, tilted or horizontal position. Successful on overhung mountings; less affected by misaligned mountings or shaft deflections. Sizes, without seals,  $\frac{1}{2}$ " to 8" shaft dia.; with built-in seals,  $\frac{1}{2}$ " to 2" shaft dia.

Wide choice of Types and Sizes  
enables you to

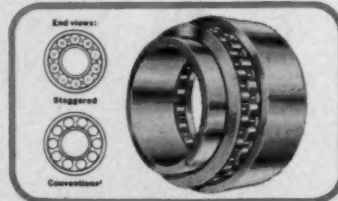
**MATCH THE BEARING  
TO THE JOB**

for maximum load capacity—speeds  
— life expectancy — and economy



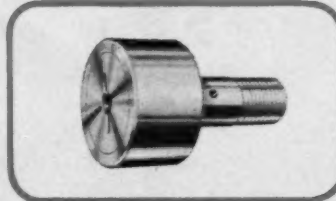
## ORANGE ROLLER BUSHINGS

Full type precision needle bearings provide maximum load capacity in small radial space. Close internal running clearances minimize possibility of misaligned rollers. Standard sizes  $\frac{1}{2}$ " to 8" shaft dia.



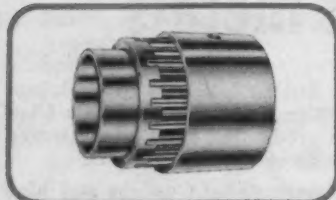
## ORANGE STAGGERED ROLLER BEARINGS

Exceptionally high load capacity and even running are gained by use of many short rollers in staggered arrangement, instead of fewer long rollers. All standard, interchangeable sizes in the 200 and 300 series.



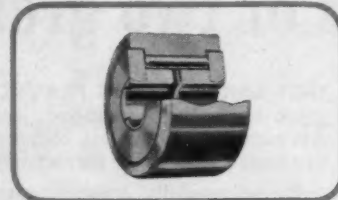
## ORANGE CAM FOLLOWERS

Provide high load capacity and shock resistance. Standard sizes from  $\frac{1}{2}$ " to 4" O. D. with either standard or heavy-duty studs. Chrome, Cadmium or Black Oxide finishes available; also seals where required.



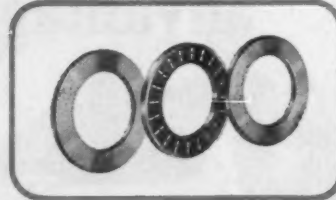
## ORANGE JOURNAL ROLLER BEARINGS

Provide high load capacity where radial space is limited. Available as complete bearings or as component parts in inch sizes, in multiple lengths,  $\frac{1}{8}$ " to 5" shaft dia.



## ORANGE CAM YOKE ROLLERS

For yoke mountings involving follower action, and for machine elements requiring guide or support rollers. Standard sizes from  $\frac{3}{4}$ " to 4" O. D. Chrome, Cadmium or Black Oxide finishes available; also seals where required.



## ORANGE THRUST ROLLER BEARINGS

Cylindrical roller type thrust bearings provide high capacity and durable service. Available in light series  $\frac{3}{8}$ " to  $3\frac{1}{2}$ " bore; heavy series from 2" to 16" bore. Special types and sizes to order.



See the complete line on display—  
BOOTH 1020 DESIGN ENGINEERING SHOW

**ORANGE ROLLER BEARING CO., Inc.**  
559 Main Street, Orange, N. J.

Send for 48-page Engineering Reference Manual  
showing dimensions, capacities, installation  
data on all Orange Roller Bearings.



## IDEAS... MATERIALS

### High-Purity Graphite Crucible

Edward W. Schrader, Western Editor

An ultrahigh-purity graphite crucible, cover and insert serve in the temperature calibration of thermocouples by the freezing-point method. The graphite container is in contact with any one of the metals normally used for thermocouple calibration. At high temperatures, the graphite oxidizes and provides the reducing atmosphere necessary for the protection of the molten metal to avoid contamination.

In calibration of the thermocouple by the freezing point method, the thermocouple is protected by an insert and the unit is immersed in the molten metal. With the switch in the "freeze" position, insufficient power is supplied to the furnace to keep the metal molten. This gives a long freeze-out time (15-20 minutes). During this interval, the metal changes state from liquid to solid. The EMF of the thermocouple is monitored at one-minute intervals. The flat portion of the cooling curve then is observed to be the EMF of the thermocouple, or the temperature at the freezing point of the metal.

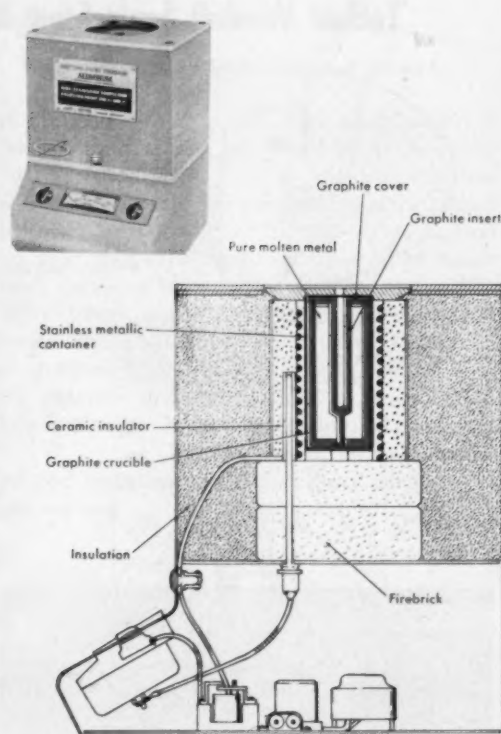
The freezing point standards are design developments of Temproton, Inc., Reseda, Calif.



GRAPHITE CRUCIBLE contains freezing point material. Insert guards thermocouple. Graphite dust sprinkled on sample protects standard from atmosphere contamination and container is then covered.

Circle 163 on Reader-Service Card for more information

## Resists Contamination



FREEZING POINT STANDARDS

STANDARD SAMPLE	FREEZING TEMPERATURE DEGREES C	APPROXIMATE ACCURACY DEGREES C	POWER REQUIREMENTS WATTS
Tin	231.8	0.01	750
Lead	327.40	0.03	750
Zinc	419.50	0.02	750
Aluminum	660.0	0.2	1000
Copper	1083.3	0.3	1250
Silver	960.8	*	1250
Gold	1063.0	*	1250

\* Assigned primary points - International Temperature Scale of 1948.

## HARD TO HANDLE chemicals, fuels, and solvents



## Special materials to tame tough fluids

Handling volatile and chemically reactive liquids is a critical problem requiring very selective use of materials in the manufacture of component parts which control, meter, pump or contain these liquids. Tough corrosive problems, as well as great extremes of temperature must often be overcome.

Among the many strategic materials, Chicago-Allis designs and custom molds into component parts for O.E.M. customers, are the fluorocarbons (DuPont's Viton-A, Dow Corning's LS-53 and 3M's Flurel) specialty synthetic rubbers, and impregnated leathers. Parts made from these materials provide the resistance and durability needed for manipulation of jet fuels, high octane gas, diesel and heating fuels, commercial solvents, chemicals and many other fluids used in a wide range of industries.

Chicago-Allis has the experience to design and manufacture mechanical seals, custom molded rubber and leather products for use in a wide range of service conditions and environments. Extensive production, experimental and engineering facilities are always at your disposal to help with your component parts requirements. Send for complete catalog information.



### CHICAGO-ALLIS MFG. CORP.

Producers of CHICAGO BELTING • ALLIS RUBBER • ALLIS SEAL Products  
121 NORTH GREEN ST. • CHICAGO 7, ILLINOIS  
Engineers • Designers • Manufacturers



Circle 164 on Reader-Service Card for more information





## HIGH SPEEDS? HIGH TEMPERATURES? CHEMICAL CORROSION?

For bearings, seals, blades and similar sliding or rotating parts, try PUREBON . . . particularly if you have a problem involving high speeds . . . high temperatures . . . or chemical corrosion.

### OUTSTANDING PROPERTIES OF PUREBON

- |                                |                                     |
|--------------------------------|-------------------------------------|
| 1. Self-lubricating            | 5. Readily machinable               |
| 2. Chemically inert            | 6. Moldable to size                 |
| 3. Stable at high temperatures | 7. Low cost, where moldable to size |
| 4. Light in weight             |                                     |

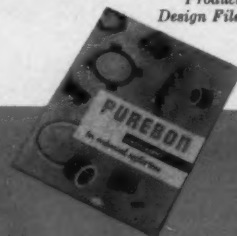
\*CARBON-GRAPHITE ESPECIALLY DESIGNED  
FOR MECHANICAL APPLICATIONS

Request  
Catalog #60  
or see Sweet's  
Product  
Design File



## PURE CARBON CO., INC.

450 Hall Avenue • St. Marys, Pennsylvania



## IDEAS . . . MATERIALS

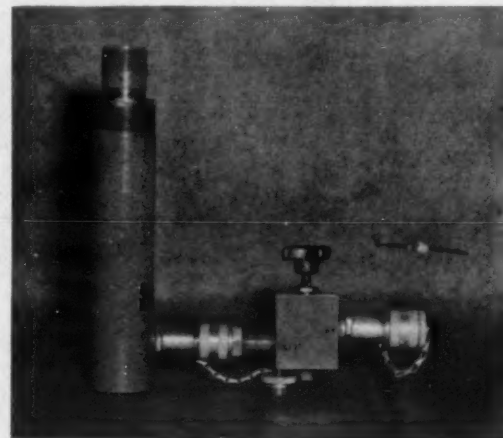
### 'Teflon' Washer Seals Stem in

Lars G. Soderholm, Midwest Editor

A release check valve, designed for operation at pressures up to 10,000 psi, uses a simple gland seal that consists of a 1/8-inch-thick "Teflon" washer squeezed between two steel washers. The bottom cavity for the ball check and spring is sealed by an ordinary forged-steel pipe plug.

The release check valve is used to permit fluid under pressure from some power source to be held in a cylinder or ram while the power source is unloaded. When the hydraulic cylinder is to be collapsed, a hand knob turns through the gland seal to push the ball check off its seat and permit flow in the reverse direction.

The hand knob cannot be unscrewed because of a slight counter-bore in the threaded portion



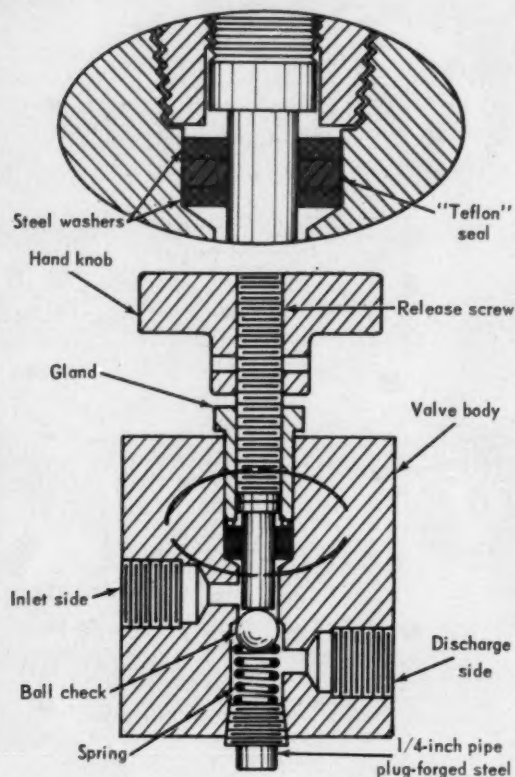
of the gland. An unthreaded flat on the release screw stops when it reaches the end of the counter-bore. To assemble, the screw must be threaded into the gland before the hand knob is pinned to the release screw.

Simplicity of the seal design against the conventional V-ring packing is apt to cause uneasiness among valve designers. The same can be said for the forged pipe plug which is used where an O-ring would be expected. The manufacturer claims, however, that in two years of testing, no failures have been reported.

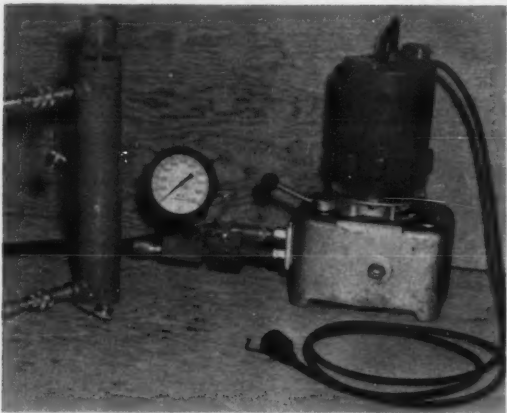
The release check valve is manufactured by the Simms Engineering Co., Chicago, Ill.

Circle 165 on Reader-Service Card for more information

## High-Pressure Release Valve



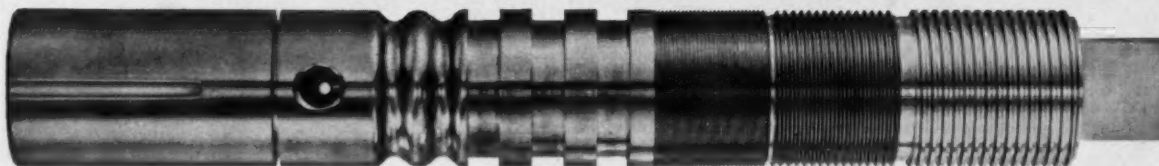
GLAND SEAL is  $\frac{1}{8}$ -inch-thick "Teflon" washer sandwiched between two  $\frac{1}{16}$ -inch-thick steel washers of approximately  $\frac{1}{4}$ -inch ID. "Teflon" washer is made with 0.002- to 0.003-inch interference fit in valve body and on stem. Nature of material prevents binding. Inlet and discharge ports have  $\frac{3}{4}$  NPT.



## THEY LAUGHED WHEN WE SAT DOWN TO PLATE...



they didn't know about **KANIGEN®**



This shaft was turned. It was key-slotted, drilled, tapped and shouldered. It was threaded, milled, grooved and chamfered. It was step-bored, with three inside diameters. Who could plate a piece like this all over—inside and out—and expect a uniform coating?

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The KANIGEN® process for chemical nickel alloy plating produces a uniform thickness of coating, re-

gardless of the contours of a part. This uniformity permits full machining operations prior to coating, with no subsequent cleanup.

KANIGEN® offers corrosion resistance equal or superior to that provided by wrought or electrolytic nickel.

For complete technical details write or call your nearest General American office. Ask for Kanigen Bulletin No. 258. You'll find that with plating as in so many other industrial areas, it pays to plan with General American.

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**GENERAL AMERICAN TRANSPORTATION CORPORATION**

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Offices in principal cities



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## Tensile Stress In Rim of Flywheels

Richard Wadler, Mechanical Engineer,  
Raytheon Co., Bedford, Mass.

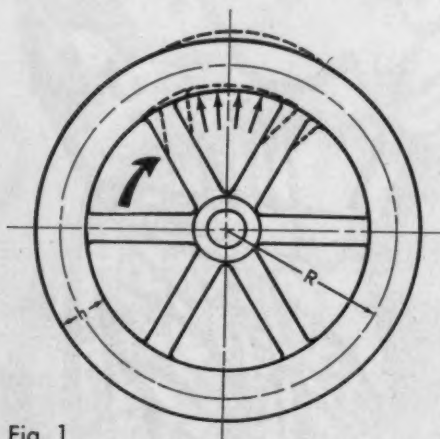


Fig. 1

Nomogram I represents the equation

$$S_t = 0.75 S_1 + 0.25 S_2$$

Where:

$S_t$  = total tensile stress, psi\*

$S_1$  = tensile stress caused by centrifugal force, psi

$S_2$  = tensile stress due to bending of rim, psi

Nomogram II represents the equation

$$S_1 = 9.14(10)^{-4} w R^2 N^2 / g$$

Where:

$w$  = specific weight of material, lb/cu in

$R$  = mean radius of rim, inches

$N$  = maximum rotary speed, rpm

$g$  = acceleration due to gravity, ft/sec/sec

Nomogram III represents the equation

$$S_2 = 1.81 (10)^{-2} w R^3 N^2 / i^2 h g$$

Where:

$i$  = number of arms

$h$  = thickness of rim inches (see Fig. 1)

Example:

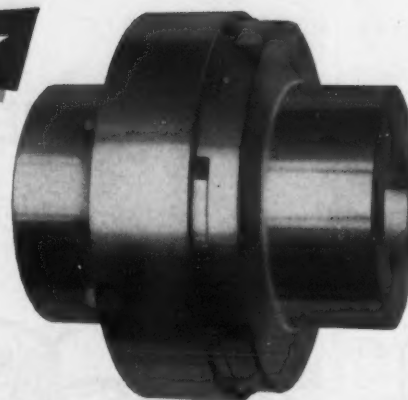
Find the total tensile stress in the rim of a cast-iron flywheel, rotating at a maximum of 500 rpm if the mean radius of the rim is 20 inches, thickness of the rim is 4 inches and there are six arms on the flywheel.

Solution:

Using Nomogram II, align  $R = 20$  inches with

# Lovejoy

## Precision Made Flexible Couplings



- Get stock delivery on any size or type you want—.003 to over 8500 hp. Specials made to order.
- Install them in seconds, using only a straight edge.
- No adjustments are needed. They contain no complicated mechanisms.
- Forget about lubrication—they don't need it.
- Run 'em dust, dirt, oil or water.
- Run 'em for years. The metal jaws never wear out, because the load is transmitted by service-rated cushions.
- Just put 'em on shafts and leave 'em alone.

Ask for Recommendations On Your  
Application. Request Catalog A-61  
and Prices.



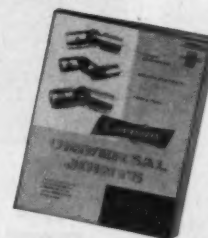
Lovejoy specializes in a full line of easily installed,  
maintenance-free power transmission equipment:



**VARIABLE SPEED PULLEYS**— $\frac{1}{4}$  to 25 hp., ratios up to 4 to 1. Request Catalog B-61.



**VARIABLE SPEED BELTS**—complete line of types and sizes for all applications. Request Catalog C-61.



**UNIVERSAL JOINTS**—for all industrial applications up to 1750 rpm., .35 to over 450 hp. Request Catalog D-61.

Motor Bases

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Take-Up Frames

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Write or phone for literature and prices. If you have a specific requirement or problem ask for recommendations. No obligation.

### LOVEJOY FLEXIBLE COUPLING CO.

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CHICAGO 44, ILLINOIS

Telephone EStebrook 9-3010 • Teletype TWX-CG-85

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SEE ALL TYPES OF POWER  
TRANSMISSION EQUIPMENT  
IN ACTION AT THE LOVEJOY  
BOOTH AT THE DESIGN SHOW

Working models of Lovejoy Power Transmission Equipment will be on display at Booth 1044. In addition, many new items will be shown. These will include: (1) heavy-duty flexible couplings rated for applications up to 8500 hp.; (2) a unique line of low-cost variable speed pulleys designed for competitively priced equipment; (3) a new and complete line of variable speed belts; and (4) a recently introduced line of universal joints for industrial applications up to 1750 rpm., fractional to over 450 hp.

The Hi-Lo Manufacturing Company, affiliate of Lovejoy Flexible Coupling Company, will also display at Booth 1044. They will feature a complete line of cam-controlled variable speed pulleys ranging from fractional to 5 hp. with ratios up to 3 to 1, also a Hi-Ratio series up to 7 to 1.

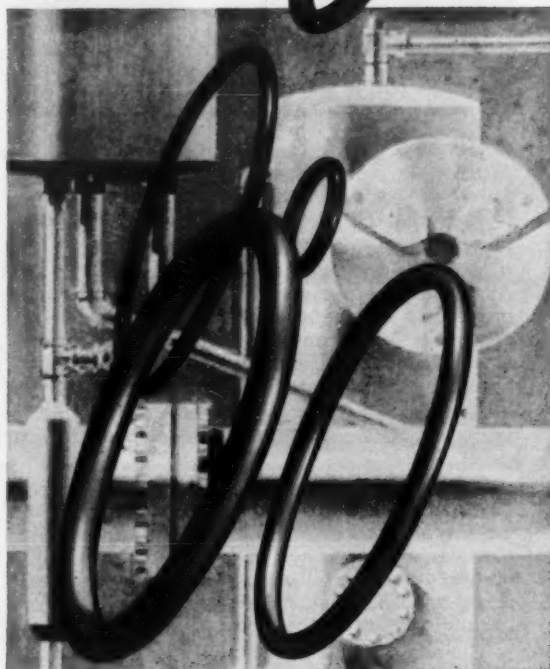
Literature on these and many other types of power transmission equipment will be available. Experienced personnel and engineers will be on hand to answer questions, give recommendations and assistance. Bring in your requirements or problems. You'll receive prompt service.

Take advantage of this opportunity to get recently published Lovejoy material containing a wealth of information about power transmission equipment—plus first hand information. There'll be no obligation on your part, only service on our part at Booth 1044.

If you are unable to attend the show, write or call for literature or recommendations on the power transmission equipment you require. Address your letter to Lovejoy Flexible Coupling Company, 4812 W. Lake St., Chicago 44, Ill. Telephone EStebrook 9-3010.

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*Stillman aircraft quality*  
*and know-how are*  
*available in " "*

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Through Stillman Technology and volume production, Stillman high-quality O-Rings are available at extremely low cost. The same quality and reliability that are engineered into O-Rings for the aircraft and missile industries are also featured in the new Stillman Industrial O-Rings. These all-purpose seals are designed for use in all phases of industrial sealing, and are uniformly high in important features of chemical resistance, low swell, long life, and sealing dependability. Stillman O-Rings are stocked in a complete range of sizes for rapid delivery.

Write for the all-new Stillman Industrial O-Ring brochure, free on request.



NOTE: Major distributorships still available in some major cities.

**STILLMAN RUBBER COMPANY**

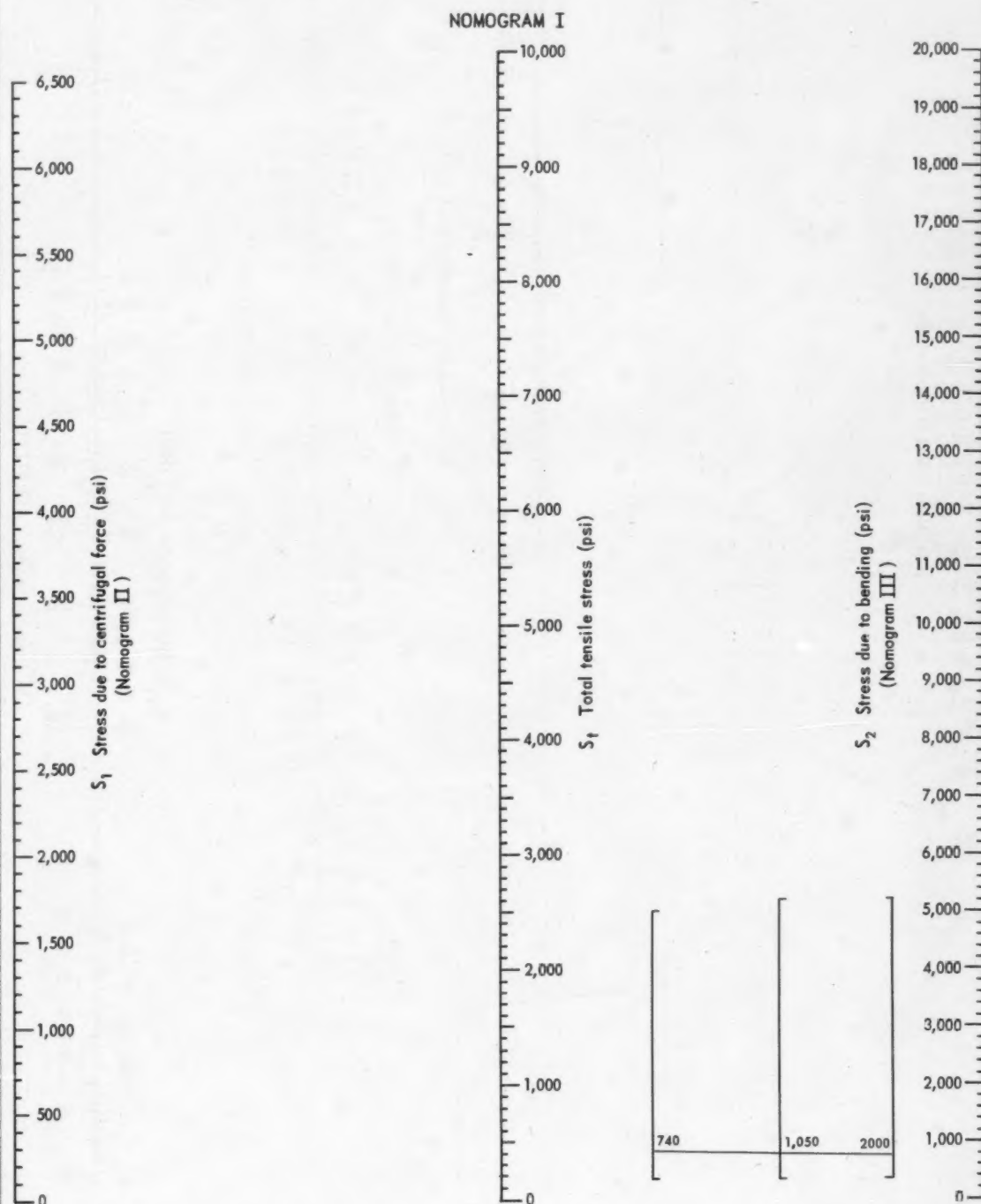
Culver City, Calif./Cleveland, Ohio/Englewood, N.J.



N for cast iron = 500 rpm, intersecting  $S_1 = 740$  psi. Using Nomogram III, align N for cast iron = 500 rpm with  $R = 20$  inches, intersecting reference line. Align this intersection with h for six arms = 4 inches and read  $S_2 = 2000$  psi. Using

Nomogram I, align  $S_1 = 740$  psi with  $S_2 = 2000$  psi and read  $S_t = 1050$  psi.

\*Reference: V. L. Maleev, "Machine Design", International Textbook Co.

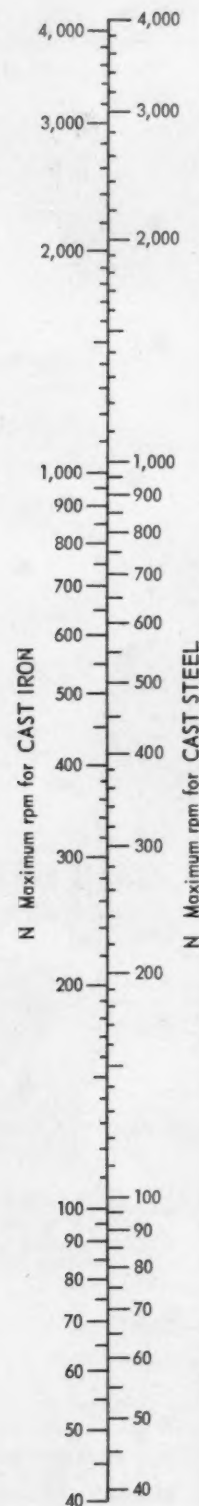
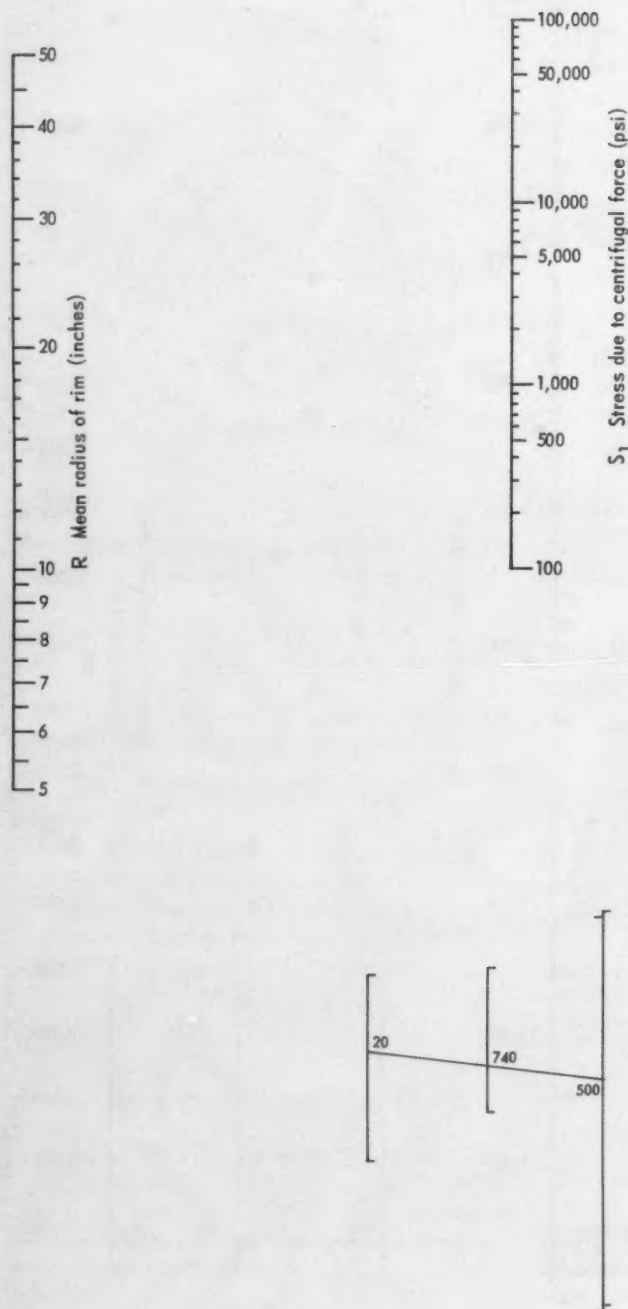


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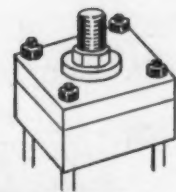
DESIGN NEWS—MAY 8, 1961



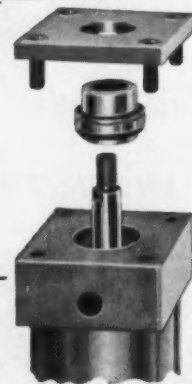
NOMOGRAM II



# Why This?



# When This Can Be Yours!



Mo-Bar Air and Hydraulic Cylinders cannot fall apart . . . because of loose tie-rods . . . when you remove the rod bushing and cartridge retainer plate of these cylinders.

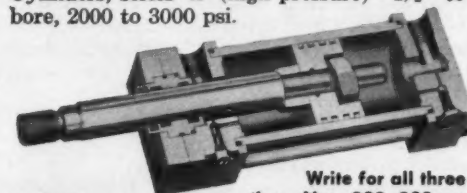
Mo-Bar's *exclusive* feature of using four (4) Allen Head cap screws in place of conventional protruding hex nuts . . . permits easy, quick replacement of the entire cylinder Rod Cartridge assembly . . . with cylinder barrel and tie-rods always permanently in place.

This Mo-Bar "first" gives greater design flexibility . . . particularly for cylinder mounting in tight places.

Other Mo-Bar "firsts" include (1) improved Rod Cartridge design where the long bronze rod bushing is *piloted* into cylinder head—not threaded—for maximum piston rod support . . . and (2) oil-heat resistant, self-adjusting Seal Guard wiper rings, with long conical taper, to throw off all harmful matter from piston rods.

The unique Mo-Bar compact design for air and hydraulic cylinders assures superior performance and unfailing dependability with positive, uniform actuation at all times.

There are Mo-Bar Air Cylinders, series 'a'—1½" to 14" bore, to 200 psi . . . Mo-Bar Hydraulic Cylinders, series 'm' (medium pressure)—1½" to 14" bore, 500 to 2000 psi . . . Mo-Bar Hydraulic Cylinders, series 'h' (high pressure)—1½" to 12" bore, 2000 to 3000 psi.



Write for all three bulletins—Nos. 202, 203 and 204—describing Mo-Bar Air and Hydraulic Cylinders for fluid power applications . . . Dept. A



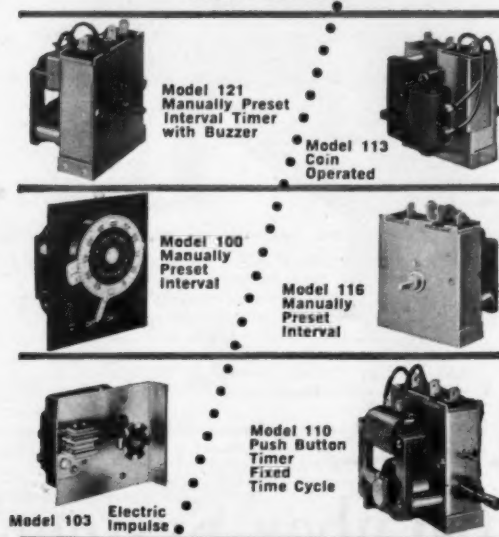
**MO-BAR**  
HYDRAULICS CO.  
Crystal Lake, Illinois

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# WIDE-RANGE SELECTION

assured with  
**MILLER-HARRIS**  
field-proved  
timers:



## APPLICATION-ENGINEERED FOR YOUR PRODUCT

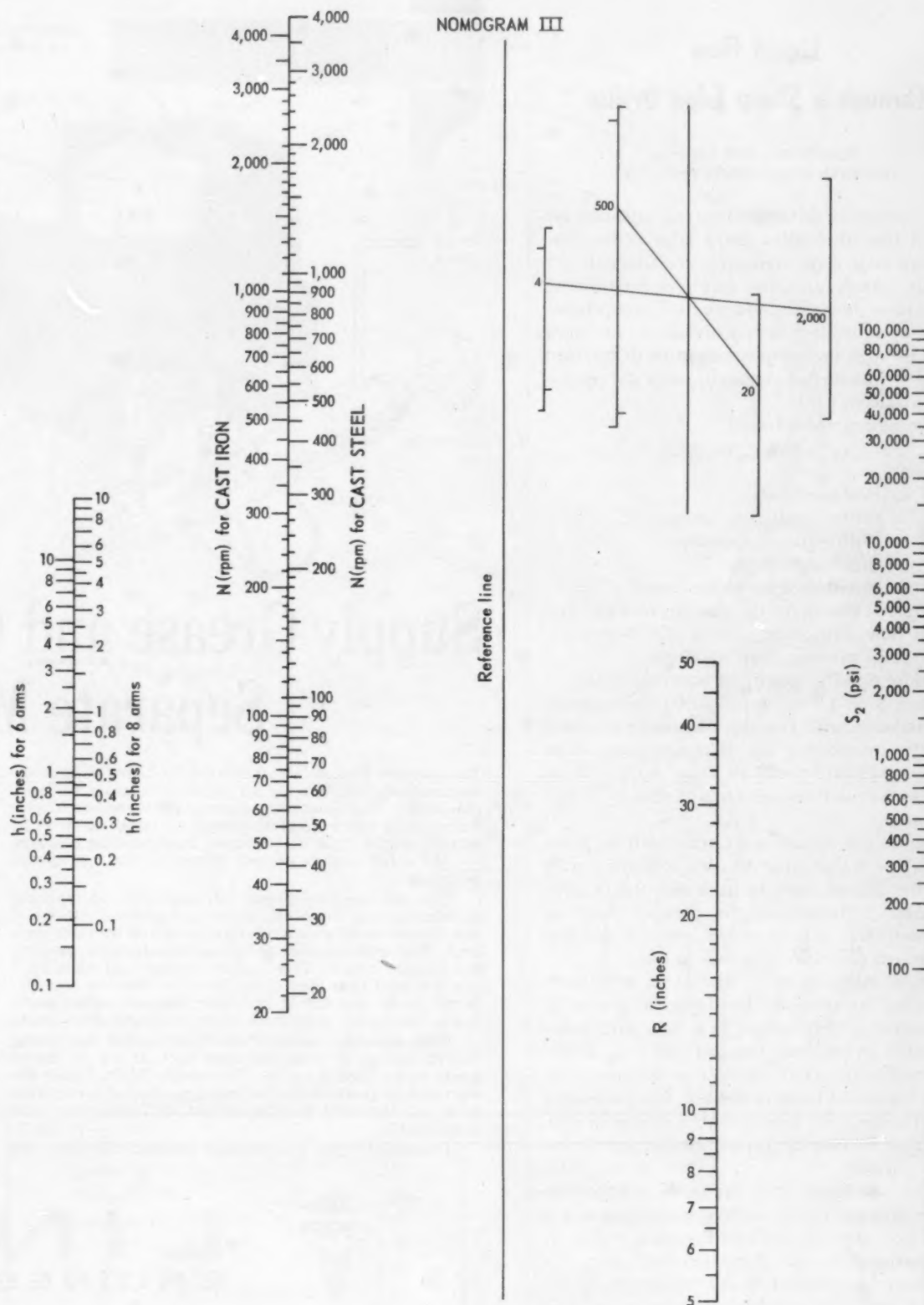
Miller-Harris offers product designers a wide choice of dependable, high-quality timers. From field-proved "Standards" to completely different "Specials," you will be sure of getting the precise timer best suited to fill your product improvement and cost-saving needs. Whatever your control timer requirements may be, you owe it to yourself and your company to know how Miller-Harris will serve you better.

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DESIGN NEWS — MAY 8, 1961



For Free Reprints of the Above Article, Circle 526 on Reader-Service Card



## DESIGN DATA

### Liquid Flow Through a Sharp Edge Orifice

Dean Holben, Sales Engineer,  
Futurecraft Corp., South El Monte, Calif.

This nomogram solves the flow rate equation for liquid flow through a sharp edge orifice, the configuration most commonly encountered.

The nomogram is also useful in determining flow rates through fluid control components rated by equivalent orifice diameters. The flow rates through the component can be determined directly from the nomogram by using the equivalent diameter.

The nomogram solves:

$$Q = 29.8 C_d D^2 \sqrt{P/S}$$

Where:

- Q = flow rate, gpm
- $C_d$  = orifice coefficient, assume 0.62
- D = orifice diameter, inches
- P = pressure drop, psi
- S = specific gravity of the liquid

Example 1: Determine the quantity of water that will flow through an orifice of 0.35-inch dia when the pressure drop is 100 psi.

Solution: Specific gravity of water = 1.0.

Align S = 1.0 on upper half of nomogram, outer scale, with P = 100 on lower half, outer scale, intersecting the reference line. Align D = 0.35 on upper half, inner scale with intersection on reference line and read Q = 22.7 gpm.

Note: Do not use an outer scale with an inner scale. The P scale must be used with the S scale and the Q scale must be used with the D scale.

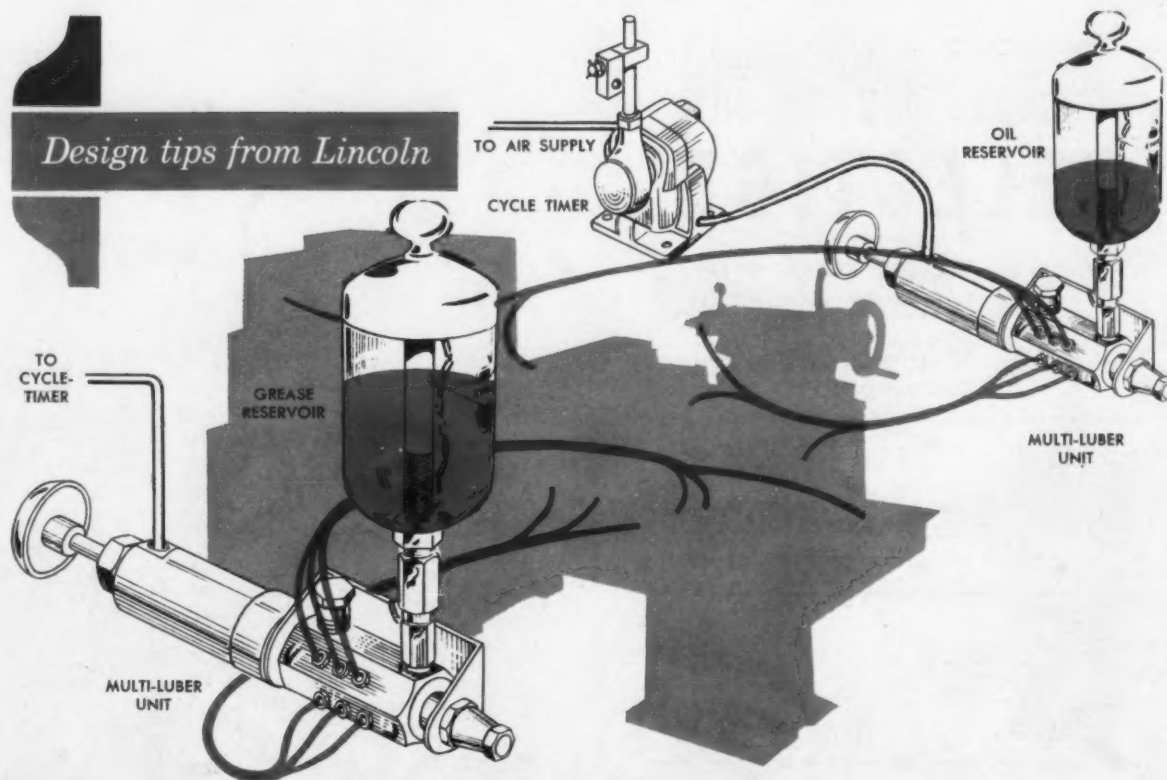
Example 2: Determine the pressure drop required for a flow of 30 gpm of gasoline through an orifice 0.50-inch in dia.

Solution: Align Q = 30 with D = 0.50, intersecting the reference line. Specific gravity of gasoline = 0.76. Align S = 0.76 with intersection on reference line and read P = 32 psi.

The specific gravity of some of the more common liquids are listed in Table 1. Specific gravity may change quite rapidly with a change in temperature. Be sure the correct specific gravity has been selected.

The nomogram may be used with orifices other than sharp edge orifices, if the flow rate is corrected properly. Because flow rate is directly proportional to the discharge coefficient, this rate may be corrected by determining  $C_d$  of the orifice used and multiplying Q by a factor of ( $C_d/0.62$ ).

### Design tips from Lincoln



## Supply Grease and Oil with Separate Multi-Luber® Systems

You can use Lincoln's versatile Multi-Luber to provide automatic lubrication for all types of bearings on light machinery. The illustration above shows how two Multi-Luber units can be used on a machine lathe: one unit to supply special light oil for super finish spindle bearings... the other unit to supply grease to the rest of the bearings.

You can use compressed air, electricity or machine motion to cycle the Multi-Luber automatically and you can choose the lubrication timing cycle you want for each unit. The unit can also be cycled manually by pushing the plunger handle. This feature is important when light oils are used that may drain from the bearing housing. Some plants cycle the Multi-Luber manually before starting up any unit, some only after prolonged shut-down.

With standard setting, the Multi-Luber discharges 0.0025 ounces of lubricant from each of the 12 outlet ports every time it cycles. The simple Multi-Luber design and its positive displacement method of lubrication give you the most reliable system for lubricating light machines.

Investigate how Multi-Luber systems can keep the

machines you design operating at the performance level your customers expect.

**Note to Manufacturers:** Lincoln will help you determine the best automatic lubrication system for your machines. Contact Lincoln's Original Equipment Sales Division.

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- ☐ Please send Multi-Luber Catalog 50.
- ☐ Have your representative call to advise on Multi-Luber adaptation to my machines.

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# LINCOLN

## ENGINEERING COMPANY

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DESIGN NEWS—MAY 8, 1961

## Calibrated, Dual Switch TEMPERATURE CONTROL

**B27A**



TYPE  
**B27A**

United Electric's Type B27A Temperature Control is a local mounted, enclosed unit that has been designed for applications where it is desirable to control two separate circuits at different temperatures by means of a single control unit. Independent switch adjustments provide a maximum span of approximately 20° F between switch settings, and this span is constantly maintained throughout the control range.

Adjustable Range . . . .	Ranges of 50° or 100° F. between limits of 50° and 400° F.
Maximum Difference Between Switch Settings . . . . .	Approximately 20° F.
Switch Ratings . . . . .	Up to 15 amps. at 115 or 230 volts A.C. 20 amp. A.C. or D.C. switches also available.
Switch Types . . . . .	N.O., N.C., or double throw — no neutral position.
Adjustments . . . . .	By rotating a single turn knob and pointer against a calibrated dial. Individual screw adjustments on switches for adjusting span between switch settings.
Electrical Connections . . . . .	Via 3/16" diameter clearance hole and an internally mounted terminal board.
Mounting . . . . .	In any position by the 1/2" NPT on the immersion element.
Enclosure . . . . .	Cast aluminum case with black wrinkle finish. Bright-dipped brass immersion element.

UNITED ELECTRIC manufactures a complete line of temperature, pressure, and vacuum controls. For special applications, standard units may be modified, or custom-built units may be provided.

For additional information on local mounted temperature controls, including Type B27A, request Section 100 of our new catalog.



**United Electric Controls**  
COMPANY

82 SCHOOL STREET, WATERTOWN, MASS.

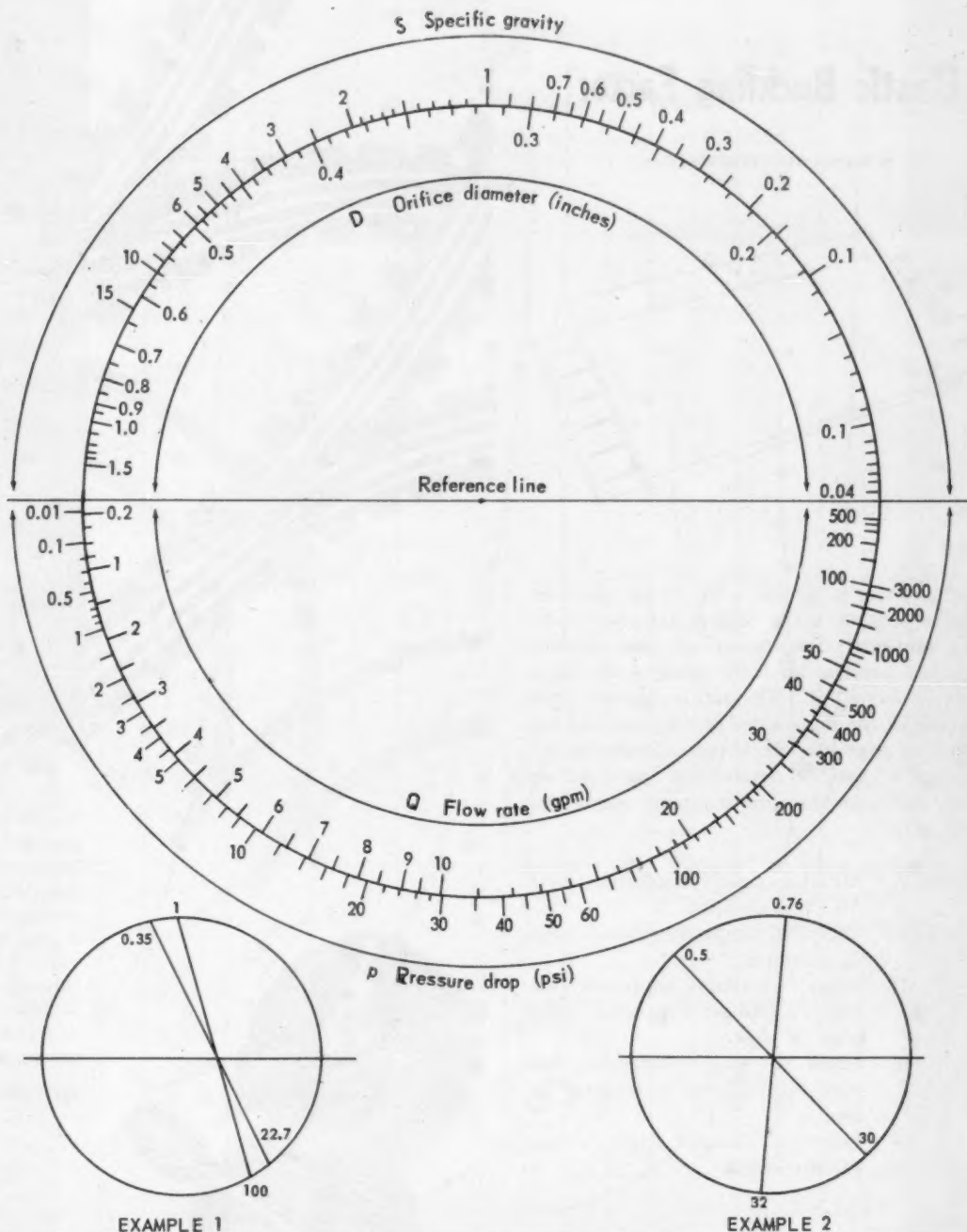
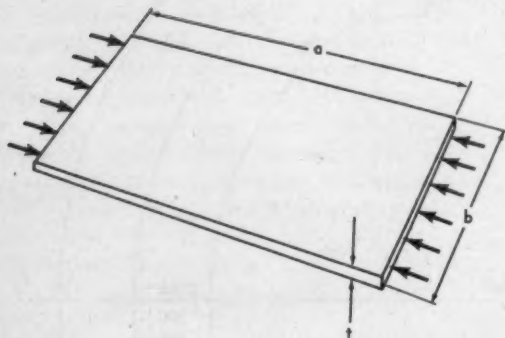


Table 1 SPECIFIC GRAVITY			
Alcohol (60F)	0.79	Hydrogen peroxide (60F)	1.40
Ammonia (32F)	0.66	Kerosene (60F)	0.82
Carbon tetrachloride (60F)	1.60	Liquid nitrogen (-320F)	0.81
Fuel MIL-F-5572 (60F)	0.70	Liquid oxygen (-297F)	1.14
Gasoline (60F)	0.76	RP-1 (60F)	0.80
Hydraulic oil MIL-O-5606 (60F)	0.85	Water (32F)	1.00



## Elastic Buckling Factor

S. Warren Kaye, Peabody, Mass.



Determination of the allowable critical unit compressive stress for a flat rectangular plate under equal uniform compression on two opposite edges is dependent upon the value of the elastic buckling factor "K". The factor depends upon the ratio of the dimensions of the plate and the manner of edge support. If plate dimensions are known, "K" can be determined from the six curves shown for the various support conditions, which are:

- Curves: A - All edges simply supported.  
 B - All edges clamped.  
 C - Edges "b" simply supported, edges "a" clamped.  
 D - Edges "b" simply supported, one edge "a" simply supported, other edge "a" free.  
 E - Edges "b" simply supported, one edge "a" clamped, other edge "a" free.  
 F - Edges "b" clamped, edges "a" simply supported.

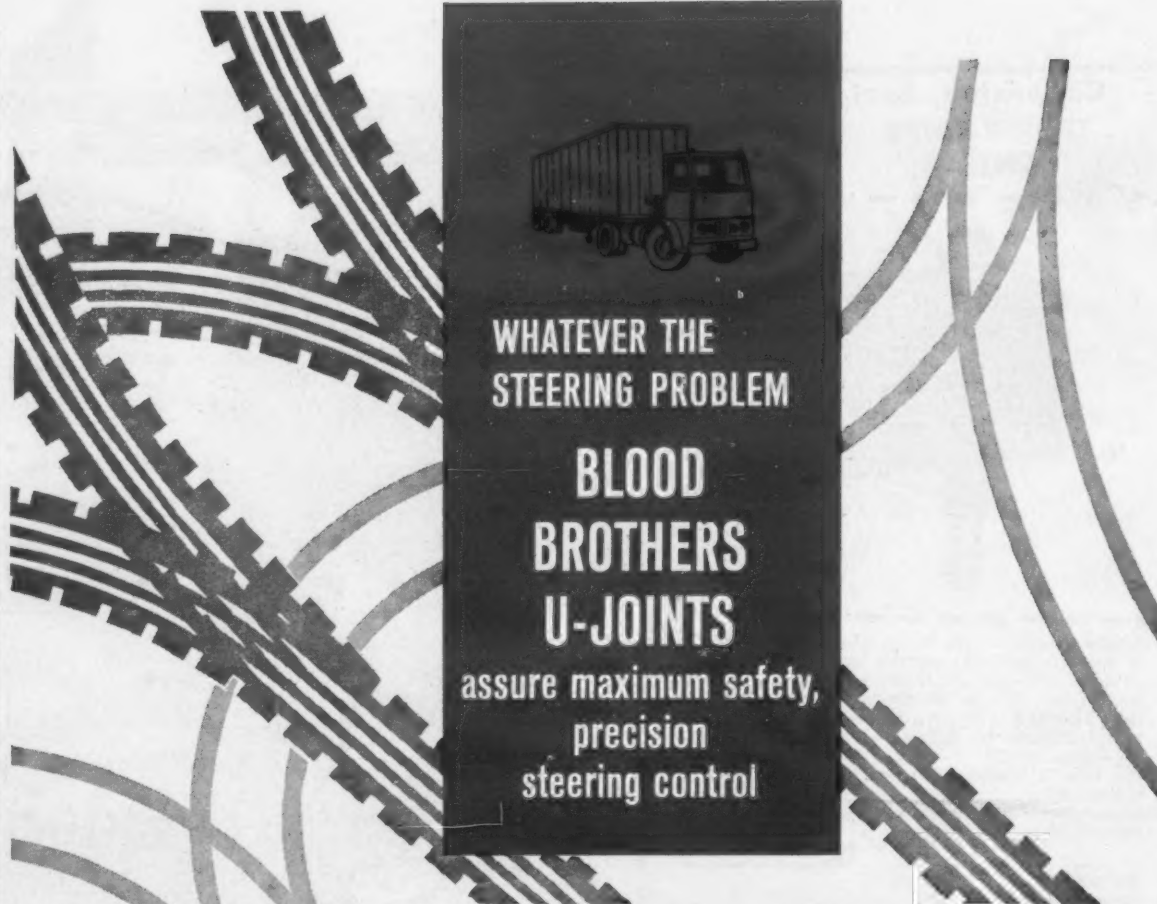
### Example:

A flat aluminum plate whose dimensions are  $a = 20$  inches,  $b = 10$  inches and  $t = 0.20$  inch is subjected to a compressive stress  $S_c$  of 14,000 psi. Determine the allowable critical compressive stress for all six cases.

### Solution:

Basic formula for all conditions is:

$$S' = K \left( \frac{E}{1 - \mu^2} \right) \left( \frac{t}{b} \right)^2$$



WHATEVER THE  
STEERING PROBLEM

BLOOD  
BROTHERS  
U-JOINTS

assure maximum safety,  
precision  
steering control

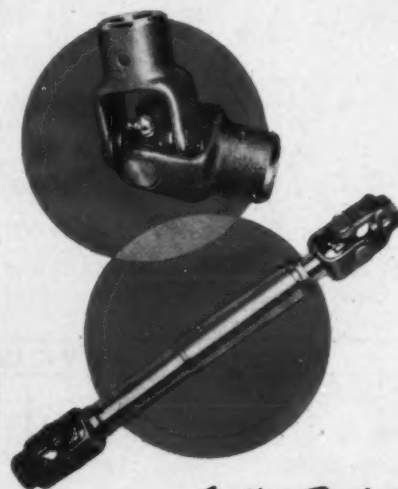
Nearly all major truck manufacturers rely on the ingenuity, ability and established leadership of Rockwell-Standard engineers to provide Blood Brothers universal joints for today's increasingly complex steering assemblies. With each new steering advancement Rockwell-Standard engineers have demonstrated their resourcefulness and skill by supplying dependable, trouble-free universal joints.

For example, the development of power steering and tilt cab trucks introduced the need for more intricate steering shaft assemblies. Rockwell-Standard engineers met the challenge with universal joints capable of transmitting power around corners without any sacrifice in operating performance or steering safety.

### PARTICULARLY IMPORTANT IS THE ROCKWELL-STANDARD DEVELOPMENT OF:

- An anti-backlash universal joint for steering columns that provides greater precision in steering control.
- A specially designed machine that tests every Blood Brothers steering joint at 4000-inch pounds of torque. This pre-shipment precaution insures dependable steering that cannot fail even under extreme torque pressure.

Whatever the steering assembly, whatever problems it presents, Rockwell-Standard engineers can design and develop universal joints that are reliable, efficient and economical.



*Another Product of...*

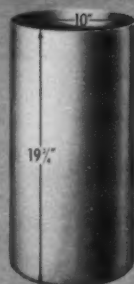
**ROCKWELL-STANDARD**  
CORPORATION



Universal Joint Division, Allegan, Michigan

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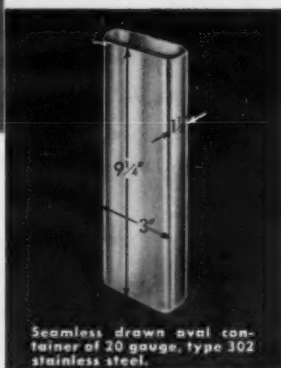
No Tooling Cost  
To Draw Shapes  
Like These  
and dozens of others  
with **POLAR WARE**  
Facilities



Seamless drawn cylindrical container of 22 gauge steel.



Seamless drawn rectangular container of 20 gauge, type 302 stainless steel.



Seamless drawn oval container of 20 gauge, type 302 stainless steel.

It will pay you to check out your new design ideas with Polar Ware. The chances are good that our hundreds of existing dies, plus the facilities of our complete tool and die shop, can save you thousands of dollars in tool cost, plus weeks of waiting time. Difficult seamless deep drawing work in stainless steel is our specialty, in gauges from 3 to 30; also carbon steel and aluminum. Take advantage of our more than 50 years' experience in metalworking. Without obligation, send your inquiry to the Contract Department.

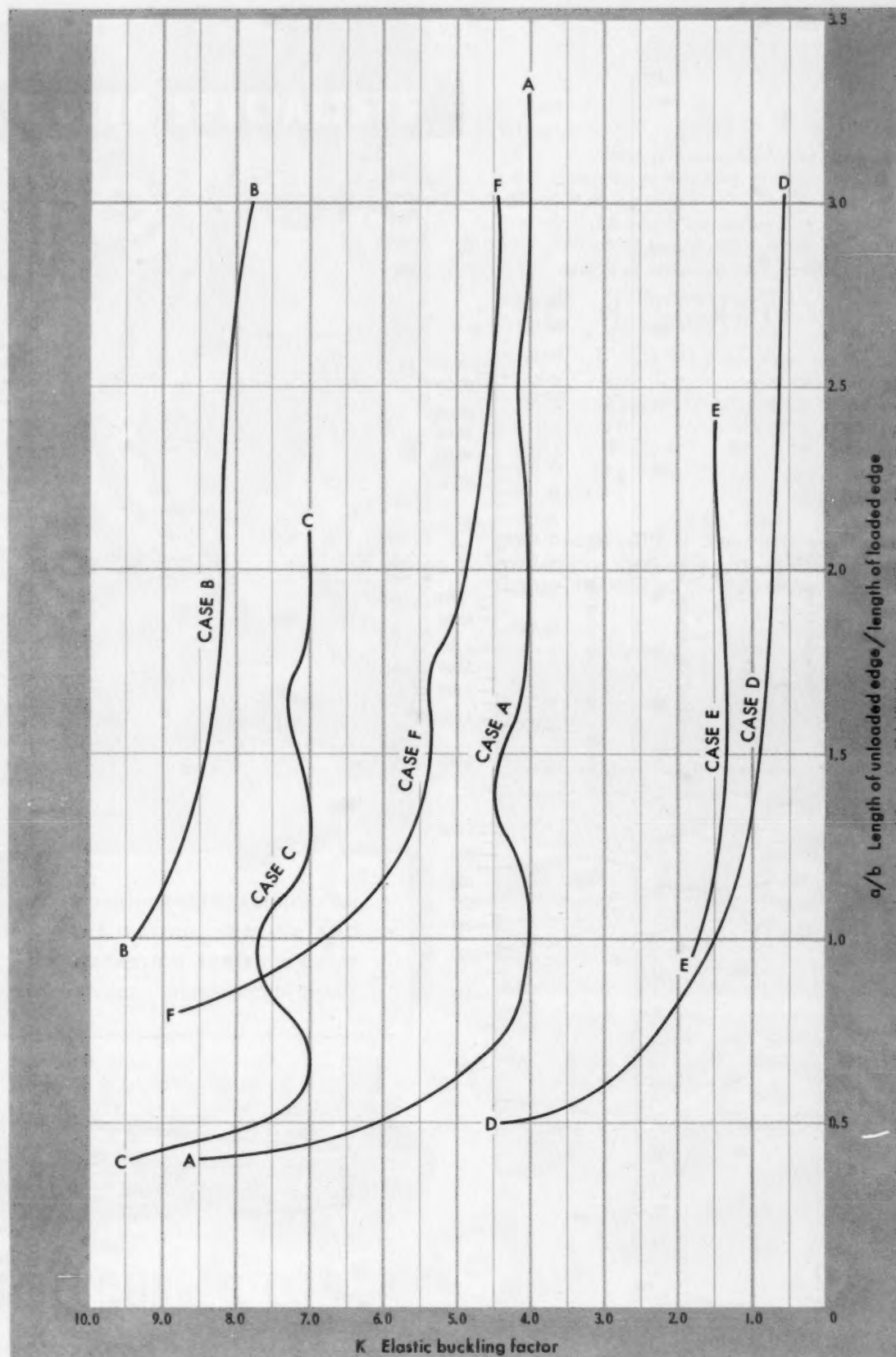


**Polar Ware Co.**

4200 Lake Shore Road—Sheboygan, Wisconsin

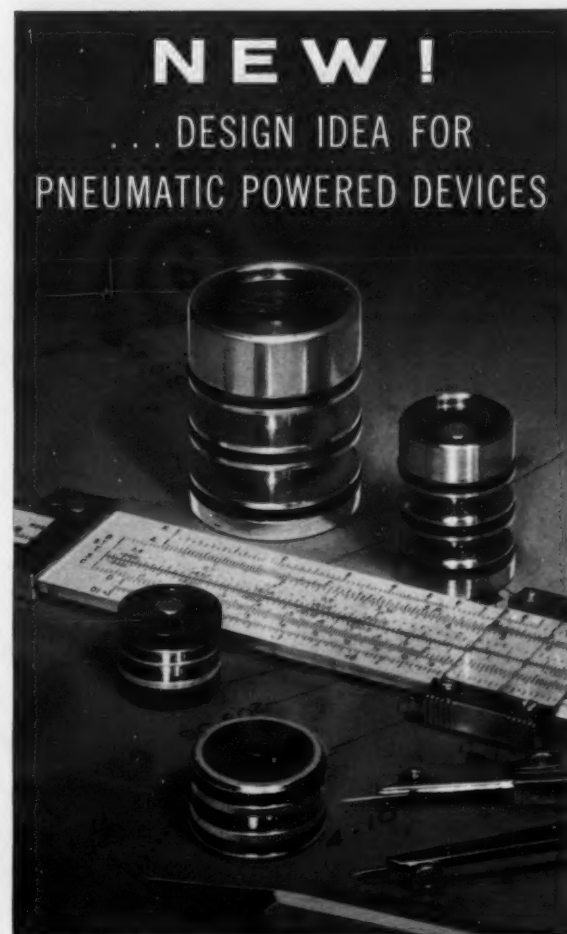
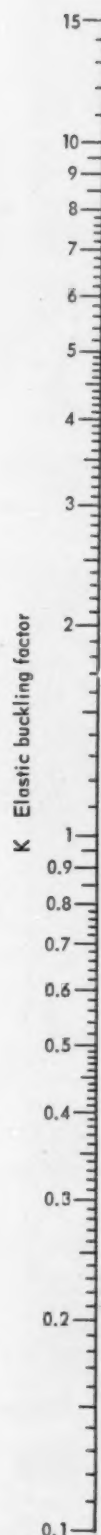
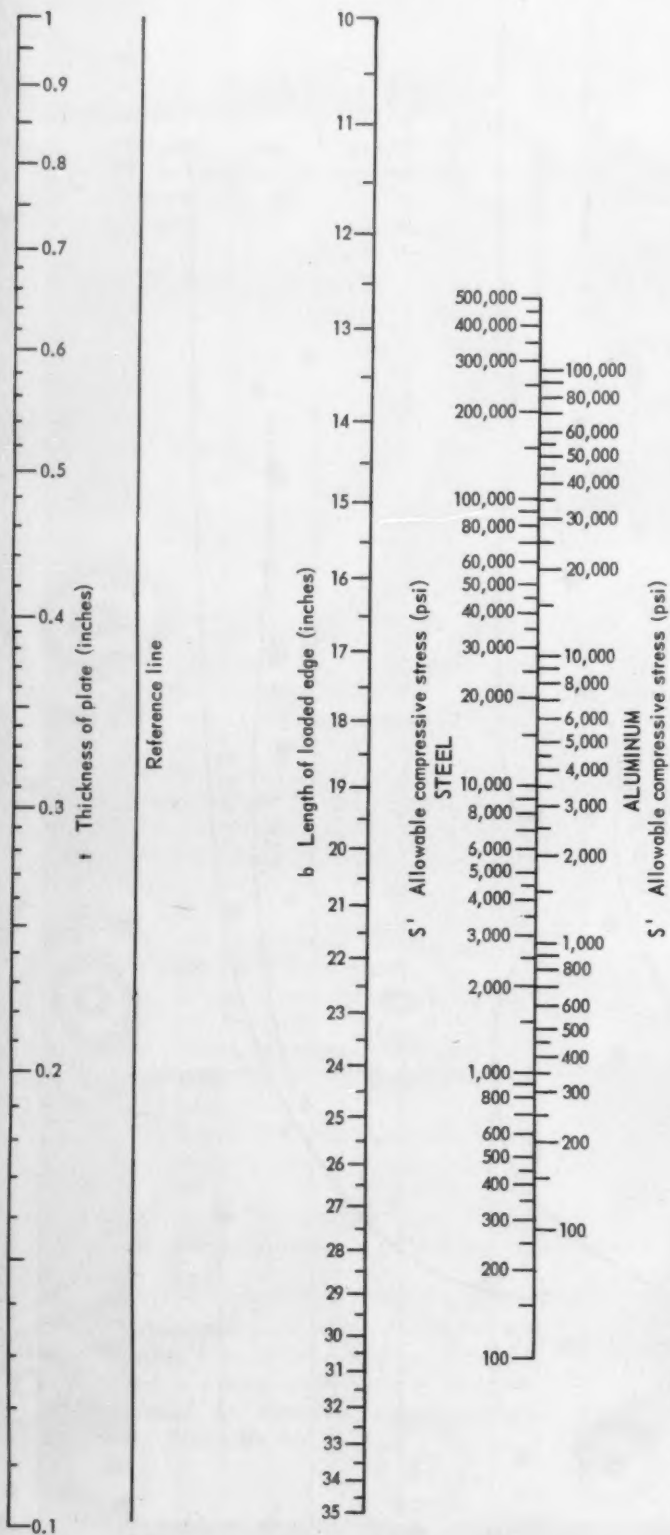
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# Elastic Buckling Factor (Cont'd)



... Put  
*Humphrey*  
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**INSIDE**  
**YOUR PRODUCT**



Also — full line of  
conventionally mounted  
"Quick-Dump" Valves...  
manual, electric, piloted.

New Home  
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Products

These Humphrey "Quick-Dump"  
Valves are installed by dropping  
them into a machined cavity, inside  
the cylinder, manifold, control  
handle, etc.

They save weight, cut material and  
component costs, reduce assembly  
time, speed up production. They  
eliminate the plumbing, permit  
installing multiple valves in small  
space, help simplify, miniaturize and  
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Choice of 2-way or 3-way, in 1/8" or  
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piloted operation. Write for  
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P.O. Box 2008, Kalamazoo, Michigan

NEW bulletin  
gives engineering  
data on Cartridge  
Valves



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# Industrial rubber

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\*Reg. T.M., E. I. Du Pont Company  
\*\*Reg. T.M., Colonial Rubber Co.



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# Colonial RUBBER COMPANY

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RAVENNA, OHIO

AXminster 6-9611

1896-A

Circle 176 on Reader-Service Card for more information

DESIGN NEWS — MAY 8, 1961

Where:

$S'$  = allowable critical compressive stress, psi  
 $E$  = modulus of elasticity, psi  
 $\mu$  = Poisson's ratio  
 $t$  = thickness of plate, inches  
 $b$  = length of loaded edge, inches  
 $a$  = length of unloaded edge, inches

$$\therefore S' = K \left( \frac{(10)(10^6)}{1 - (0.3)^2} \right) \left( \frac{0.2}{10} \right)^2 = K(4395.6)$$

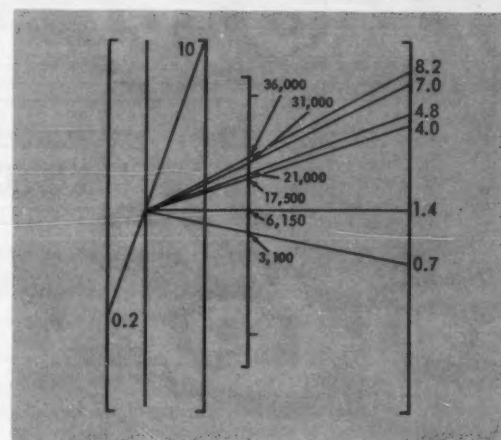
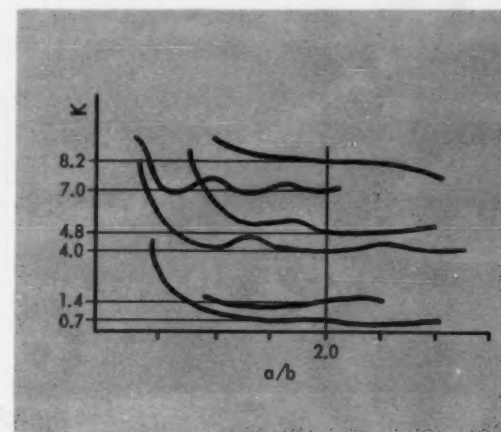
Cases

- (A)  $K = 4.0$
- (B)  $K = 8.2$
- (C)  $K = 7.0$
- (D)  $K = 0.7$
- (E)  $K = 1.4$
- (F)  $K = 4.8$

From Nomogram

- $S' \cong 17,500$  psi
- $S' \cong 36,000$  psi
- $S' \cong 31,000$  psi
- $S' \cong 3,100$  psi
- $S' \cong 6,000$  psi
- $S' \cong 21,000$  psi

Note: Cases D and E are found to be inadequate. Also, for most loadings, specifically when  $a/b > 1$ , case B is the most adequate method of support.

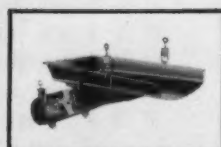


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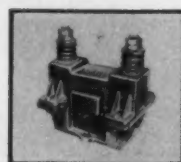


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## Materials Handling Equipment



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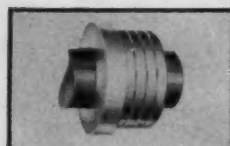


BIN VIBRATORS



PARTS FEEDERS

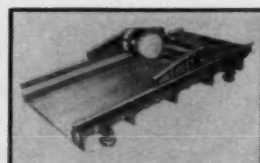
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## NEW LITERATURE

### Positive Drives

451

#### Booth 346

Why and how positive drives combine the advantages of belt and gear or chain drives, while avoiding disadvantages of metal-to-metal contact, noise and need for lubrication. Catalog PD-1 is a 48-page engineering and drive-selection manual giving full construction details on grooved pulleys and the steel cable belts with cogged undersides that grip the pulleys with gear-drive positiveness. Capacity range of the manufacturer's positive drive (fractional to 600 hp) and the horsepower-to-weight ratio are explained. Engineering and selection tables cover five stock pitches in which the positive drives are available. Separate drive tables and horsepower ratings for each pitch provide helpful selection data. Maurey Mfg. Corp., 2907 S. Wabash Ave., Chicago 16, Ill.

### Roll Drawing File

452

#### Booth 1238

Beginning with a brief outline of the history of filing engineering records, this 28-page reference touches on the evolution of file systems from the beginning through methods commonly used today. A summary is given of a survey made by the manufacturer's engineers which led to the development of "Inter-Lock" files and their applications. Questions pertaining to economy, space requirements, fire resistance and convenience are answered and suggestions are made for installation layouts, instructions and accessories. Pack Mfg. Co., 55 W. First North, Logan, Utah.

### Metal Hose and Tubing

453

#### Booth 312

Made in bronze, brass, steel, stainless steel, aluminum, "Monel" cupro nickel and "Teflon", a complete line of flexible-metal hose and tubing is described in this 60-page catalog. The two basic types of hose and tubing—corrugated and stripwound—are explained. A complete index lists hose types by their uses and an ordering guide is provided. Catalog G-601R contains tables of specifications for the hose and tubing as well as for fittings. The manufacturer's district sales offices are listed and pictures are included of quality control operations and equipment in use in the company's laboratory and plant. Anaconda Metal Hose Div., Anaconda American Brass Co., Waterbury 20, Conn.

PREVIEW OF LITERATURE to be shown at the DESIGN ENGINEERING SHOW, Cobo Hall, Detroit, Mich., May 22-25, 1961... A helpful directory for those who plan to attend... a useful summary for those who can't attend this year.

### Drafting Room Equipment

454

#### Booth 732

Drafting tables, plan files and drawer units are featured in Catalog 11. The 38-page catalog also includes drawing boards, kits, stools and drafting room aids such as pencil pointers, erasing shields, protractors, triangular scales, clipboards, T-squares and straightedges. Tables of specifications, complete ordering information, shipping and sales policies are provided. All units are illustrated. Mayline Co., Inc., Sheboygan, Wis.

### Relays

455

#### Booth 201

Mercury-to-mercury control relays, time-delay relays, load relays and mercury-wetted contact relays are illustrated in this 16-page brochure. Operation, advantages, applications, selection factors, ratings and operating characteristics are detailed for the units. A section on type MW mercury-wetted contact relays also includes information on contact protection and dynamic characteristics. Quality, guarantee and laboratory approvals are discussed. The Adams & Westlake Co., Elkhart, Ind.

### Gears, Clutches

456

#### Booth 1001

This 552-page catalog, No. 65, details a complete line of gears, clutches, speed reducers and differentials. Also included are latest developments in electromechanical components. An alphabetical index provides easy location of any component or assembly on which data are desired. Specifications tables, catalog numbers and list prices complete the catalog. Sterling Precision Corp., 5 Sintsink Dr., Port Washington, N. Y.

### Magnetic Drives

457

#### Booth 945

Available in ratings of 50 to 2500 hp, a magnetic drive and its components are fully described in Bulletin 3650. Sections of the six-page form cover theory of operation, design features, torque transmission and speed control, controls, applications, specifications and dimensions. The Louis Allis Co., Milwaukee 1, Wis.

## Booths 720 and 726

Catalog 960 is a 64-page design manual on reduced dimension, lightweight types of self-locking fasteners. Its purpose is to provide the design engineer with a concentrated package of nut shapes covering complete lines of miniature hex-, anchor- and clinch-types useful in assembly of units intended for avionic and electronic end use. Special emphasis is placed on clinch types, including a new "floating" type of blind fastener and two new right-angle bracket nuts suitable for panel and cover assemblies. Complete instructions on how to install clinch nuts are given; available tools and production methods are illustrated. Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.

## Coordinatographs

459

## Booth 1127

List KA 61 E describes the "Aristo" line of coordinatographs, accurate within  $\pm 0.0012$  inch. Constructional characteristics of the units are pointed out and uses of the equipment are shown diagrammatically. Various models and accessories are shown in this eight-page folder. Unitech Corp., 50 Colfax Ave., Clifton, N. J.

## Caster Wheels

460

## Booth 1038

Form No. 11961 illustrates polyurethane Duro/Tred caster wheels, available in 5-, 6-, 8-, 10- and 12-inch dia sizes. A table showing swivel-series casters, wheel number, wheel face and hub-length size, axle size and load capacity completes the bulletin. Faultless Caster Corp., Evansville 7, Ind.

## Roller Chain

461

## Booth 1228

A new straight-link power-transmission chain, Tuf-Flex, is described in Form No. 2600TF. The roller chain was designed for heavy-duty applications such as concrete transit-mix trucks and power excavating shovels. Dimensional data and list prices are given, and a complete list of industrial distributors is provided. Diamond Chain Co., Inc., 402 Kentucky Ave., Indianapolis 7, Ind.

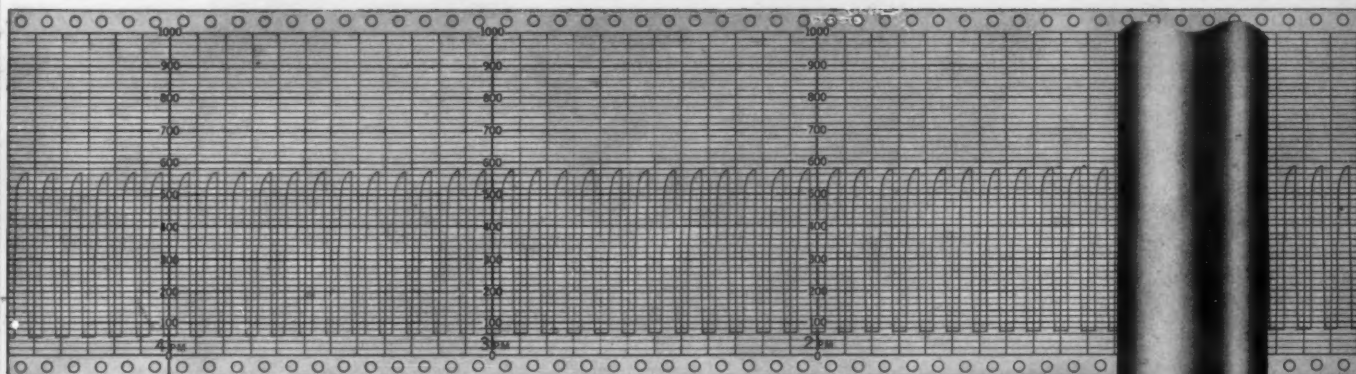


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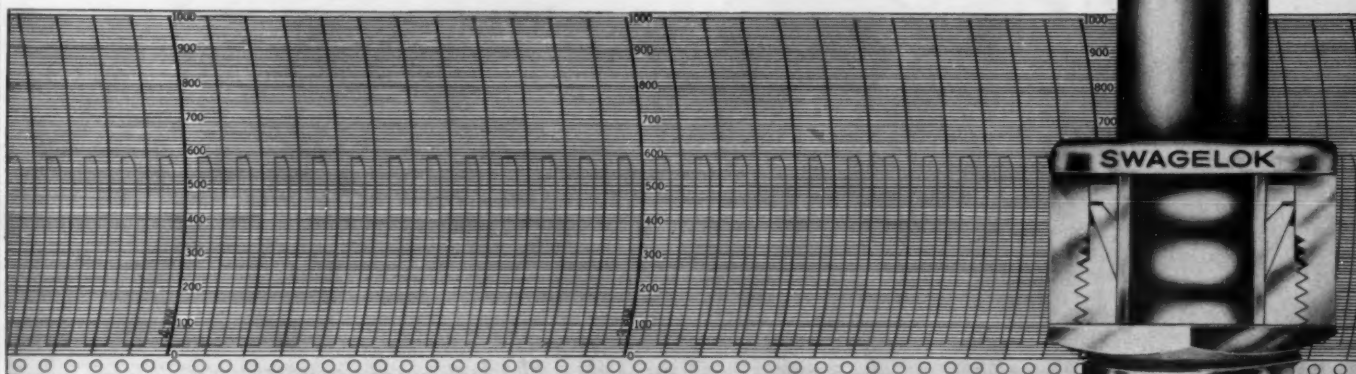
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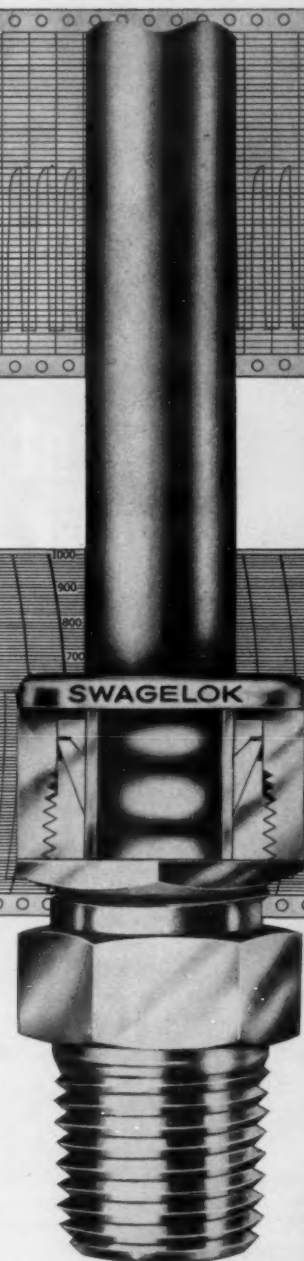
**PRESSURE VS TIME RECORDING:** The maximum pressures on the chart were produced by 600 psi superheated steam at a source temperature of 750° F. The minimum pressures were the result of opening the system dump valve and flushing with 50° F., 500 psi cold water.

The tests recorded on the above charts were conducted on one inch carbon steel hydraulic tubing (ASTM-A-179) using carbon steel SWAGELOK Fittings. Thirteen to sixteen SWAGELOK Tube Fitting connections were in the systems and 1200 severe thermal shocks were applied on each of two different tubing configurations without leaks or failure. The conditions used in this test were considered casualty or mal-operation conditions and are not recommended practice for any system design.

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Visit **SWAGELOK Booth 1108** at the **Design Engineering Show, Cobo Hall, Detroit, May 22-25, 1961**

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## LITERATURE

### Air Controls

462

#### Booth 107

A line of units providing instrument-pure air free of dirt, water and oil at a lowered dew point, 65 deg or more below the safe standard for "instrument-quality" air. Package combinations using Aqua-Jet filter, Diatrol regulator, Whirlflo filter and/or Chem-guard dehydrator are illustrated. Filters, dehydrators and regulators as separate units are described with tables of specifications. Circular 1040 lists accessories such as lubricators, needle valves, gages and drains and shows the various sales offices through which the units are marketed. Wilkerson Corp., 1601 W. Girard Ave., Englewood, Colo.

### Fasteners

463

#### Booth 915

"Nylatch" fasteners, their applications, installation and construction are detailed in an eight-page booklet. Test results and technical data for the multipurpose fasteners show sheet separation versus static tension, static tension versus cycles operating, creep characteristics, vibration characteristics, impact characteristics, materials and temperature effects. The Hartwell Corp., 9035 Venice Blvd., Los Angeles 34, Calif.

### Tungsten Alloys

464

#### Booth 562

Proven uses of "Kennametal" and "Kentalium" for designers, engineers, researchers and inventors are illustrated and discussed in this 24-page brochure. Form B-666 gives outstanding properties of wear resistance, stiffness, compressive strength, corrosion resistance, weight, impact, galling, dimensional stability, hot strength and oxidation resistance for the hard carbide alloys. Production, engineering and research facilities of the company are described. Kennametal, Inc., Latrobe, Pa.

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**WASHINGTON:**  
Seattle..... Tri-State Supply Co.  
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Milwaukee..... General Plastics, Inc.  
West Allis..... Colonial Kolonite Co.

## Automatic Control Equipment

465

### Booth 1237

Descriptive and engineering information on a complete line of standard equipment designed to fulfill most electrical timing and magnetic-control requirements. Catalog 18-B is divided into four sections covering automatic transfer switches, contactors, special controls and timing devices. Each section contains dimension data, list prices and general information. Terms and conditions of sale are described and names and addresses of sales representatives are listed in this 64-page catalog. Zenith Electric Co., 152 W. Walton St., Chicago 10, Ill.

## Ball and Roller Bearings

466

### Booth 137

Detailed engineering data on Reali-Slim bearings, their advantages and design considerations. Formulas and methods for finding capacities and life ratings and flame-hardening techniques are given. Charts cover life and speed factors and cross-section drawings show bearing types, separator types, types of seals and bearings of unusual design. Full-page charts provide specifications on each of six series of ball bearings, a radial roller-bearing series and a single-row taper roller-bearing series. Catalog No. 54, 28 pages, includes specifications of the Reali-Slim type "CP" Conrad deep-groove ball bearings available "off the shelf". The Kaydon Engineering Corp., Muskegon, Mich.

## Printed-Board Connectors

467

### Booth 228

Form P2-39 presents a complete line of printed-board connectors for flat conductor cable and flexible etched circuitry. Applications include data-processing equipment, communications systems, motor-control panels, alarm and signal systems, guidance systems and test equipment. A table of sizes available, dimensions and catalog number facilitates ordering. The Pos-E-Kon Div., The Thomas & Betts Co., Inc., 36 Butler St., Elizabeth, N. J.

## Packings and Gaskets

468

### Booth 918

Packing recommendation charts, molded hydraulic and pneumatic packings, "Teflon" gaskets and packings, plastic packings and various other gasket materials are featured in Form P-100, 64 pages. Common causes for packing failure, advantages of lantern glands and suggested procedure for proper installation of packings are included. A steam table, a table of water heads and equivalent pressures, circumferences and areas of circles, a Fahrenheit and Centigrade conversion table, metric conversion table and a table of decimal equivalents make this a useful reference manual. Raybestos-Manhattan, Inc., Packing Div., Passaic, N. J.

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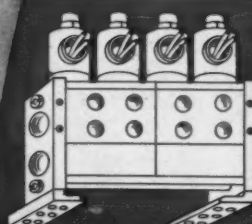
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**FOUR STATION CO-ORDINATE**

With Optional Threaded Exhaust  
This assembly requires only 8" of space.  
Each additional valve station adds only 1 3/4"  
to overall length.

# Co-Ordinates

■ Now... You can mount an unlimited number of Versa Series "A" Solenoid Valves as one integrated unit with these new Versa Co-Ordinate Assemblies. These versatile assemblies make possible simplicity of design in both Hydraulic and Pneumatic operation, because only one inlet is required to feed the entire line of valves, and where threaded exhaust block is used, only one exhaust connection need be made. They are so versatile that additional blocks can be added at any time and so compatible that blocks with and without adjustable built-in bleed controls can be used together in one unit. ■ The Versa Series "A" Solenoid Valves used with this assembly are the largest capacity valves for their size. These four-way valves have a full 3/16" diameter flow area and measure only 1 3/8" in diameter. ■ Combined with Versa "A" Valves these Co-Ordinates provide the most flexible and reliable Multiple Solenoid Valve Assemblies in the Hydraulic and Pneumatic Control Valve field. ■ Co-Ordinates are available from authorized Versa Distributors throughout the world. Write for Bulletin #960.



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## Choice of Battery Systems

C. G. Grimes and W. S. Herbert,  
The Electric Storage Battery Co., Yardley, Pa.

For a long time, the lead-acid battery has been the workhorse in the field of secondary batteries. The relative simplicity of the electrochemical reaction, high cell voltage, absence of criticality in physical configuration and a generous supply in nature of rather inexpensive basic materials are all factors which have contributed to the commanding position of lead-acid batteries. Lacking this fortunate combination of good technical and economic features, other systems were relegated to a position of secondary importance, while industrial development emphasized the lead-acid work.

There has been a great improvement in the battery during this period—improvement in its electrochemical performance, in the energy-density ratio, in packaging and in life. Most of this improvement has been the result of years of development wherein progress has been achieved by incremental improvements as opposed to any profound advance which could be attributed to research. The latter has been somewhat neglected. In general, it might be said that research in lead-acid couples has become a reality only in the post-war period. One seldom hears any reference to the electrochemical efficiency of the lead-acid battery. This is quite understandable when, after a hundred years of development, the efficiency is about one-half of what it could and should be.

The electrochemical systems most prominently considered today for storage battery use are lead-acid, nickel-iron, nickel-cadmium, silver-zinc, silver-cadmium and fuel cells. The latter are electrochemically, batteries.

In considering the choice of a battery system to best fulfill requirements of an application, many factors other than capacity must be weighed. Usually, it is a compromise of many characteristics, among which are weight, volume, availability, rechargeability, cycle life, stand life, cost and maintenance. In Table 1 values are listed for 100 amp-hr size batteries at the 10-hr rate for some of these battery systems. It is interesting to note that the lead-acid cell has one characteristic which sets it apart from those systems with which it is compared, that is, its high cell voltage. This factor offsets the higher density of the lead, and gives, in fact, a better energy-weight ratio than is found in the other "work-type" batteries—nickel-cadmium and nickel-iron. It is

TABLE 1 ENERGY DENSITIES OF COMMON BATTERY SYSTEMS 100 AMP-HR SIZE					
BATTERY TYPE	VOLTAGE PER CELL		ENERGY DENSITY FOR 12V BATTERY		
	OPEN CIRCUIT	AVERAGE VOLTAGE	NO. OF CELLS	WHR/LB	WHR/IN <sup>3</sup>
Lead acid					
Aviation	2.1	1.9	6	13.1	1.0
Ironclad	2.1	1.9	6	13.1	1.35
Automotive	2.1	1.9	6	15.0	1.3
Nickel-Cadmium					
Pocket	1.28-1.30	1.2	10	11.0	0.6
Sintered	1.28-1.30	1.2	10	11.5	0.88
Nickel-Iron					
Tube type	1.5	1.2	10	10.6	0.92
Silver-Zinc	1.86 on higher plateau 1.58 on lower plateau	1.55	8	85-100	3.0
Silver-Cadmium	1.40 on higher plateau 1.12 on lower plateau	1.06	11	50.75	2.5
O <sub>2</sub> -H <sub>2</sub> Fuel cell (Dry chemical fuel storage)		0.7	16	~ 120	

NOTE: Based on room temperature discharges at the 10-hr rate.

also observed from Table 1 that the silver systems offer very great weight and volume advantages. However, this simple comparison is but the first approximation as to choice of battery systems for a particular application. Extended tables of the performance and economic factors for each system, under various conditions of load and temperature, would be necessary to permit logical selection of the optimum system for a specific application. Nevertheless, it is apparent that where weight and size are critical factors and cycle life or cost are of lesser importance, the silver-zinc and silver-cadmium systems are to be preferred.

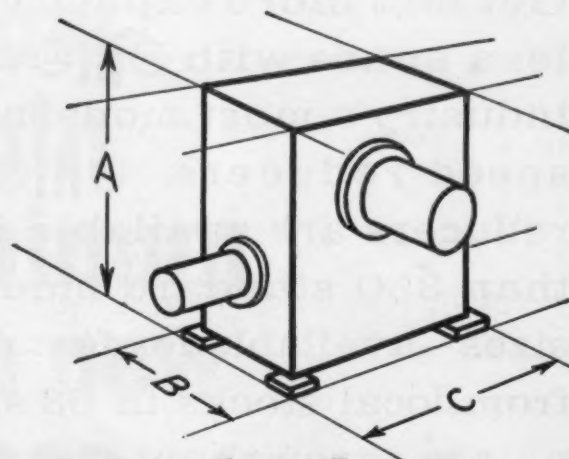
Other factors which affect the choice of a system are shown in Table 2. These factors include ease of recharge, life and costs. The industrial-type lead-acid battery is better than the other systems on the basis of cost-per-unit energy output over the life of the battery. Automotive-type lead-acid batteries will have a lower initial cost than any of the systems, but because of its better cycle life, the industrial type is the more economical.

Nuclear batteries offer a great potential but the development of high-rate, high energy-density, inexpensive batteries must await the development of new knowledge. For the foreseeable future, the nuclear battery will have application as a high potential source, but will be seriously limited in rate performance, watts per pound and cost. Thermoelectric cells, used for the conversion of heat energy to electrical energy, are merely a new approach to an old problem. The technical art in

(Continued on next page)

# Do-It-Yourself...

## Let's design a speed reducer today



So you can't find a speed reducer to fit your latest brainchild without ruining the design? Doggone manufacturers all build reducers too big to fit into those few cubic feet you've got left for the reduction unit back behind the double-ended dingbat?

Revolt! Design your own! Show 'em!

By George, design it yourself and it'll fit. How? Well, you know your size limits. Draw the biggest box that'll fit the space and you've got your reducer housing specifications.

Now you need gears that will (1) transmit the needed horsepower under all operating conditions, (2) provide the ratio your machine requires and (3) fit the space that's available. You'll soon discover that there are limits to what gears can do in transmitting horsepower. The cheapest answer is parallel shaft helical gears. If they'll fit you're in clover. But they take the most room, especially when you're out of the fractional hp range. The right angle worm and gear combination is the most compact drive arrangement.

Here again you have a choice. Cylindrical worm gearing is often used, and if it'll do the job, is worth consideration. But it's not the most compact possibility. The best way to shrink gears and still carry the load is the double-enveloping worm gear design. Both worm and gear are throated and the two literally wrap around each other. This brings center distance of the two shafts closer together and you can put them inside smaller housings.

Does this reduce load capacity? No sir! You

can carry the same load with center distances up to 33% smaller than those of cylindrical worm gears. Or use the same center distance and carry a greater load. Will these gears hold up in operation? Sure, if you beef up the teeth, the bearings and the housing. Use straight-sided worm and gear teeth and you'll get all the strength there you'll ever need. Use large taper roller bearings with real B-10 life. Use a reinforced, heavy wall housing that won't distort under load. Put fins on it for added cooling and increased thermal horsepower capacity to meet your needs. Now, put the whole thing together and you've got a speed reducer that's a dilly.

Designing your own speed reducer give you a headache? Looking for an easier way? There is one. Someone's already done exactly what you're talking about. You can order that compact speed reducer right off the shelf. Where?

Cone-Drive Gears, that's where!

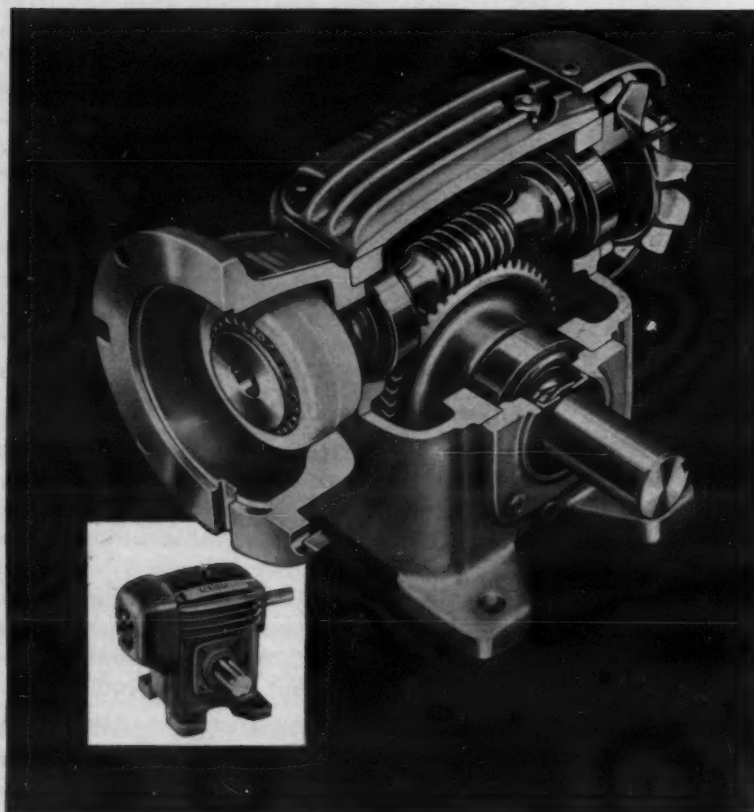
Yes sir. They stock double-enveloping worm gear speed reducers from fractional to 665 hp. Standard ratios from 5:1 to 70:1 in about 15 increments, all interchangeable in any type housing of a given center distance. Worms over and worms under. Gear shafts vertical, too. Single- or double-extended output shafts, or shaft mounted. Over 200,000 combinations possible. Wow! Just about anything you want.

Better get Cone-Drive's new speed reducer catalog that details everything. Ask for Bulletin CD-218. Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

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Get 80% more capacity in 25% less space with **OHIO LINE**... industry's most modern line of speed reducers. **OHIO LINE** reducers are available in more than 350 standard models and sizes—available for fast delivery from local stocks in 63 strategic points throughout the country. Write for a complete 246 page catalog: Ohio Gear Company, 1312 E. 179<sup>th</sup> St., Cleveland 10, Ohio



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## Battery Systems . . . Cont.

this field is still developing and currently the systems suffer from low efficiencies, low energy density and high costs.

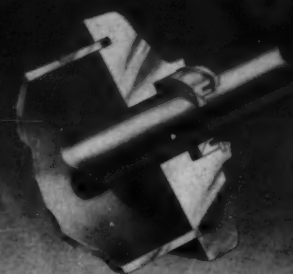
Remarkable progress has been made in the past 10 years in the development of a practical fuel cell. Most of the reported work in fuel cells to date involves the use of hydrogen or mixtures of hydrogen and hydrocarbon as the fuel and oxygen as the oxidizer. While most of the interest in fuel cells is focused on their use as power-generating sources, they also have some potential when utilizing carbonaceous fuels as chemical reactors producing both power and a useful byproduct. Likewise, the fuel-cell electrode system is readily adaptable to use in chemical processing. Other features of the fuel cell make it very attractive to certain military applications, ranging from submarine propulsion to auxiliary power units in space satellites and silent power sources for ground use.

In considering the impact of a practical fuel cell on the storage battery field, one must keep in mind the fact that a fuel cell is an electrochemical battery wherein the "active materials" are stored externally to the cell and are capable of being fed in continuously. In other words, it is a battery capable of continuous discharge for extended periods of time. Consider, therefore, that the fuel cell consists of two major components:

TABLE 2 COMPARISON OF BATTERY SYSTEMS  
100 AMP-HR - 12V

BATTERY TYPE		EST. LIFE	EST. INIT. COST	COST YEAR	COST CYCLE
Lead-Acid	Constant potential recharge or stepped current recharge in 5-19 hours				
Automotive		300 cycles 3 years	\$40.	\$13.	13¢
Industrial		5-10 years 1600 cycles	\$70.	\$ 9.	4.3¢
Nickel-Cadmium	Recharge at constant potential 7-8 hours				
Pocket		10-20 years 2000 cycles	\$150.	\$ 6.	7.5¢
Sintered	Vented cells can be recharged in 2 hours. Sealed cells can be recharged in 10 hours. Require no water.	10-20 years 3000 cycles	\$300.	\$20.	10¢
Nickel-Iron	Charge at constant potential in 6-7 hours				
Tubular		15-20 years 2000 cycles	\$130.	\$ 7.5	6.5¢
Silver-Zinc	Recharge at constant potential 4-20 hours	1 year 200 cycles	\$800.	\$800.	400¢
Silver-Cadmium	Recharge at constant potential 4-20 hours	2-3 years 300 cycles	\$1000.	\$400.	200¢

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- **INCLUDES SCRAPER-WIPER**—lip on outer wedge is integral wiper
- **FITS SIMPLE COUNTER-BORE IN CYLINDER HEAD**—is secured with snap ring

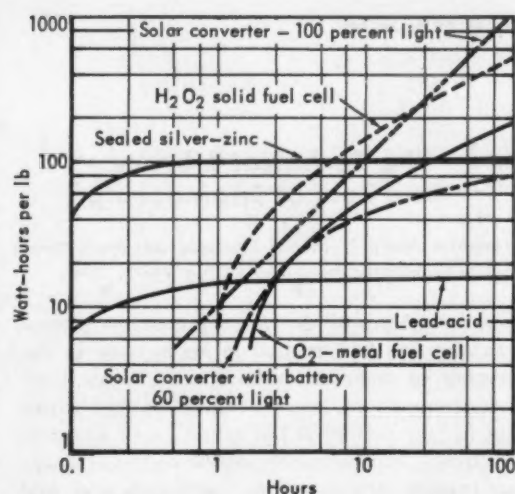
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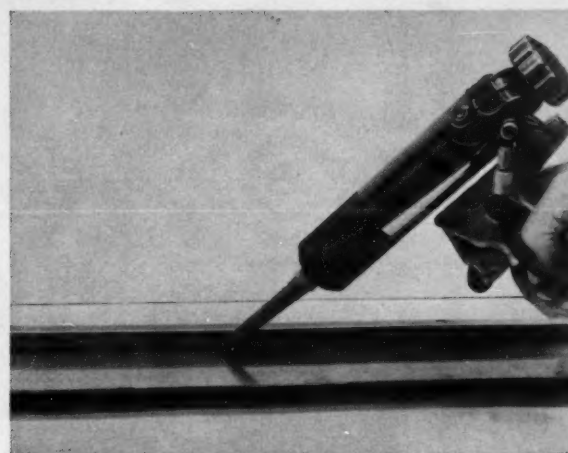
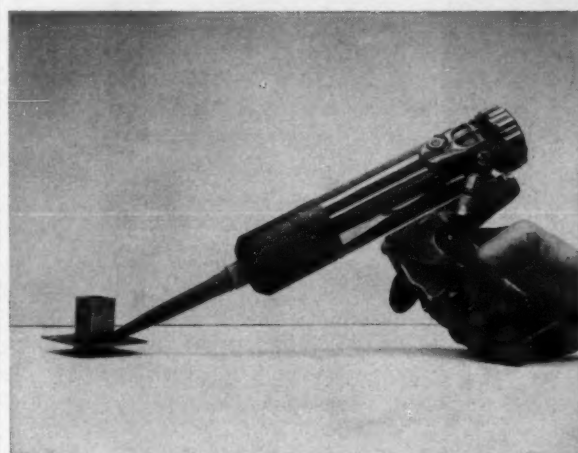
1. The "active materials" or fuel and oxidant.
2. The assembly of catalytic electrodes, fuel- and oxidant-handling systems, end-product disposal system, electrical connections, electrolyte and container. The second group of components we will term the "reactor".

Hence, regardless of the watt-hour capacity of the unit, there is a definite fixed weight and volume attributable to the reactor. This, in turn, is directly related to rate and voltage. The fuel cell is, therefore, at a decided disadvantage, weight and volume-wise, when applied to uses wherein the demand for continuous power supply is of relatively short duration. A comparison of the energy-densities versus duration of continuous discharge for storage batteries, fuel cells and solar converters is shown in Fig. 1. From this figure, it is evident that the theoretical hydrogen-oxygen fuel cell employing fuel storage in the solid state to reduce weight will have a lower watt-hour per pound rating than will a sealed silver-zinc battery, when the duration of continuous power demand is less than six hr. Compared to the lead-acid battery, the crossover point is slightly in excess of one hr. For the solar converter in 100 percent light, the values are 10 hr and 1.5 hr respectively.

There are many possible types of fuel cells, varying in complexity, as well as efficiencies. And just as in the case of batteries, no one type will best fulfill all applications. The more complex types, in general, will be best suited to fixed installations, while the simpler ones will have more use in portable units.

Abstracted from a technical paper, "The Choice of Battery Systems"; SAE No. 269D; \$75; to SAE members, \$50. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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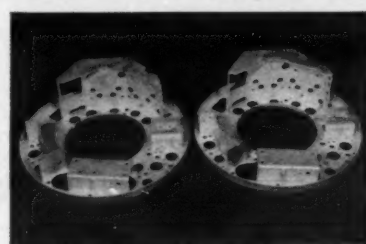


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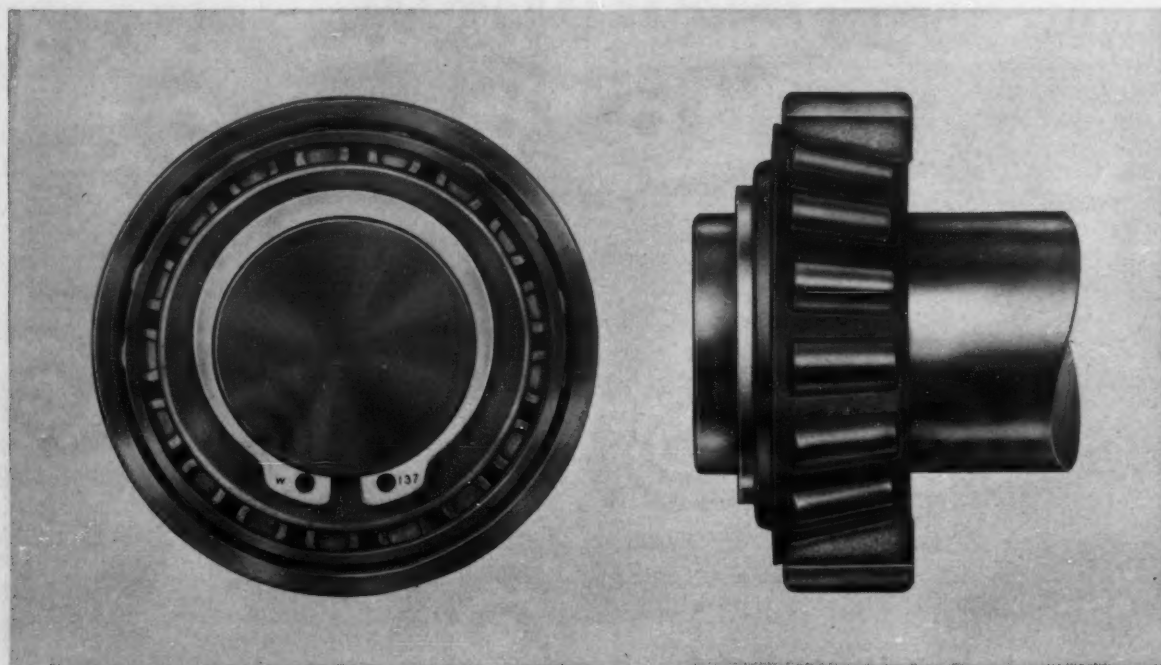
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and other bulkier and more expensive fastening devices normally required for extreme loading conditions. The Truarc Series 5160 is available in 11 popular sizes for shafts ranging from .473" to 2.0" dia. — and other sizes are on the way. You can order the Series 5160 in carbon spring steel or — for corrosion resistance and high temperature limits — in Armco PH 15-7 Mo stainless steel. Sizes up to 1.378" also are available in beryllium copper. For complete specifications, write for Truarc Data Bulletin No. 459-11. Better yet, contact your local Truarc Representative or Distributor. They're listed in the Classified Telephone Directory under "Retaining Rings" or "Rings, Retaining."

**SEE FOR YOURSELF** — Send for a free sample of the Truarc Series 5160 Heavy-Duty ring. We'll include a standard external ring of the same size for comparison. You'll see the difference as soon as you open the envelope!

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61-1



## The Technical Library As a Tool of Engineering

Harold S. Sharp, Technical Librarian, AC Spark Plug Div., General Motors Corp., Milwaukee, Wis.

Since the turn of the present century, intense specialization has resulted in an increase in the number of technical publications—books, journals, transactions, reports—until, as one writer put it, "the periodical has added a new terror to research." Approximately 60,000 technical books are printed throughout the world each year, and miscellaneous papers are produced at a rate impossible to estimate. Between 25,000 and 30,000 different periodicals are published annually, containing about two million articles.

In today's highly complex society no one can be sufficient unto himself. Unless research engineers have access to what has already been done in a given field, they will inevitably "repeat the past", losing both time and dollars. Fortunately, much of the past has been recorded and these records have been preserved. Research, to a great extent, involves the examining of records of the past before turning to actual laboratory experiments in order to avoid unnecessary, expensive duplication of effort.

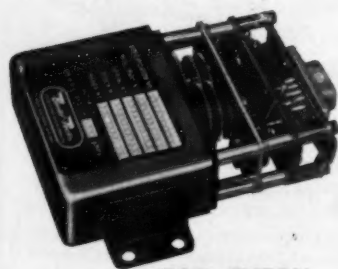
This brings us to the question which is the heart of the matter: how is information to support engineering research to be obtained? Answer: establish a company-operated technical library. There are in the U. S. today more than 4000 such libraries operated by industrial concerns. These are in addition to public and university libraries, although universities almost invariably include in their collections a great deal of material of great value to the research engineer.

The technical library is a storehouse of knowledge. Its mission is to select and procure information, the nature of which is of interest to its patrons, and to catalog, index and store this information in such a manner that any portion of it may be quickly extracted from the whole. On the face of it, this would seem fairly easy to accomplish, but such is not the case. Many concerns, realizing the need for specialized information, but underestimating the technical requirements for efficient information retrieval, have designated an ex-stenographer (whose shorthand leaves something to be desired) as librarian. She is given a sign, "Librarian", for her desk, receives a \$10 raise and the company has a "library!"

It is vital that a qualified professional librarian

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be engaged at the outset, just as one should engage an architect to design a house. Many companies, after struggling along for several years with their stenographer-engineer operated "libraries", finally recruit a professional librarian to bring order out of the chaos created by uninformed library management. This setting the house in order is extremely expensive, in terms of time, effort and money. It is far better to start off right in the first place by engaging a qualified technician—in other words, a professional technical librarian.

The librarian is a specialist. He is familiar with the tools of the library just as an engineer is familiar with the tools of his profession. His education includes a Bachelor's degree, generally in one of the sciences, plus a Master's degree in Library Science. In addition, he has served an apprenticeship as assistant librarian in a technical library and often has taken additional university courses in the subject field or fields in which his employer is engaged. Basically, he is an information specialist. He knows techniques for collecting, organizing, filing and indexing published materials in such a way that he can bring the library user and the published materials together. He can provide specific answers to questions, either from his own knowledge or from published records. He can use not only the collection in his particular library but also the accumulated materials in the 4000 plus other technical libraries around the country.

In short, the technical librarian is a professional man. He is the key to the successful operation of the company-operated technical library. In setting up a company library, the engaging of a qualified technical librarian is a must. Without him an efficient library simply cannot exist.

The librarian, like any other specialist, needs the proper tools with which to work. A niggardly library budget defeats the purpose of the technical library and management should realize this at the outset.

Library tools may be grouped into four basic areas and it would be well to examine these. The card catalog has been called "the heart of the library".

Cards are prepared for each book in the collection and are filed alphabetically. The alphabetical entries cover the author, title and subject or subjects pertaining to the books. Thus, the user may determine quickly all books in the collection by a given author, or all books on a specific subject. Each card gives a bibliographical notation describing the individual book: date and place of publication, the publisher's name, the number of pages, and information concerning illustrations, charts, graphs, diagrams, tables and bibliographies, if any. With this indexing system, the user may, with only the vaguest information con-

(Continued on next page)



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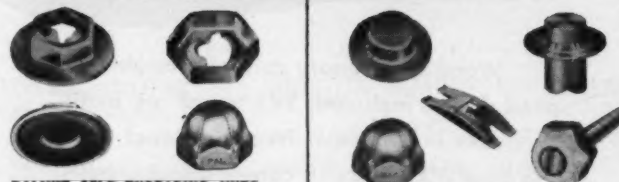
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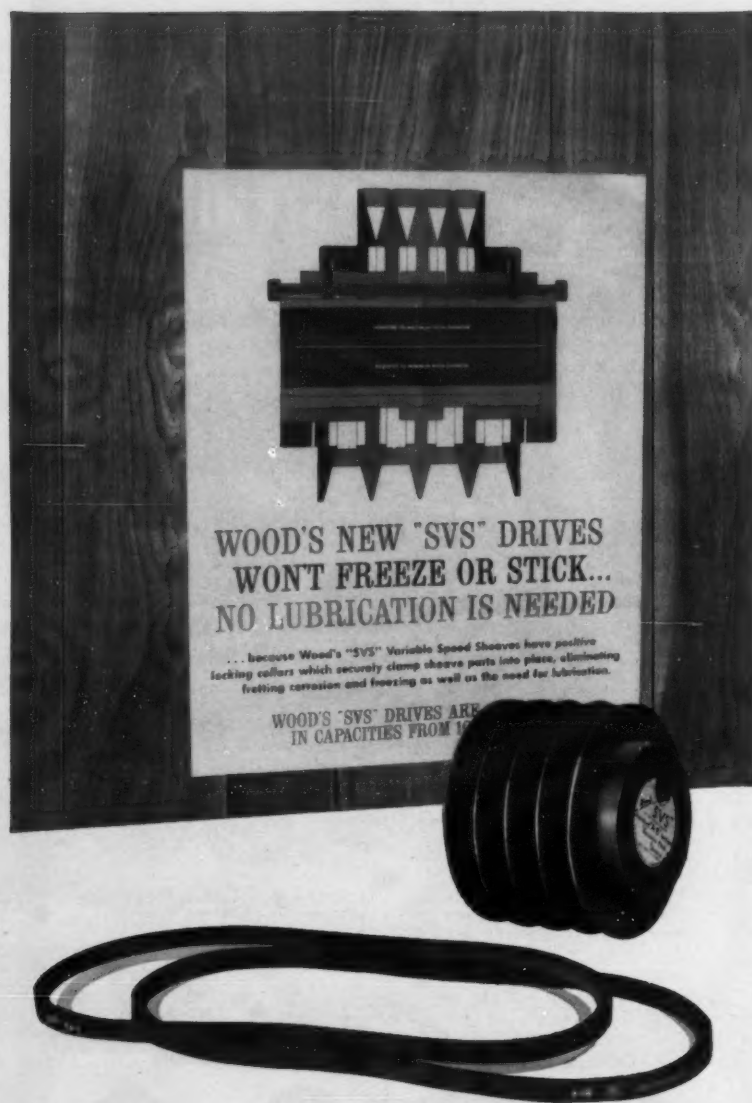
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## The Technical Library . . . Cont.

cerning the book he desires, locate it quickly and easily. The books themselves are numbered and placed on the shelves in numerical order, the numbers appearing on the book cards. Thus, books are brought together on the shelves by subject, an extra convenience for the user who might wish general subject information rather than a particular book. This subject shelving permits the patron to examine not one but several books in the information area desired.

It is obviously impossible, with the huge amount of published information available today, to have all of it concentrated in one spot. Even the Library of Congress at Washington, with its millions of items, does not claim to have a copy of everything ever published. By using indexes and abstracts, much material located elsewhere can be pinpointed and, if advisable, ordered by the librarian on an inter-library loan basis. Some of these indexes, such as the "Engineering Index", are put out at regular intervals in card form, with the cards published annually in one book. The Wilson publications are issued throughout the year and are cumulated several times during the year and annually. Some indexes include abstracts of the published articles to which they refer; others do not.

Bibliographies are also valuable library tools. Where indexes and abstracts, such as those mentioned, are general in subject, bibliographies deal with one specific subject. These give information sources on the subject indicated; some are exhaustive, while others are extremely sketchy.

Factual information is to be found in subject handbooks. These are, as a rule, broad in scope and contain much factual information with little explanatory text. An example of this would be the "Handbook of Chemistry and Physics".

In addition to the library tools discussed, there are dictionaries, reports, encyclopedias, directories, patents and many others. These all contain information which, if used properly, will assist the engineer and his employer in making maximum use of their time.

One man can no longer know everything. The more we learn the more there remains to learn. One man learns and records what he learns. Other men, seeking to improve the first man's efforts, read the record, and that is where the technical librarian proves his worth. By obtaining recorded information for those who need it, working quickly and efficiently, he can save time, effort and money.

Abstracted from a paper entitled "The Technical Library as a Tool of Engineering"; ISA 16 SL61. Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

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- No. 61-MD-2 "Material Standardization to Reduce Cost"
- No. 61-MD-3 "Special Requirements of Hydraulic Circuits for Servo-Controlled Machinery"
- No. 61-MD-4 "Drives for Tape-Controlled Machine Tools"
- No. 61-MD-5 "Ceramic Materials: A Chemical and Structural Description"
- No. 61-MD-6 "What Do Glasses and Ceramics Offer the Design Engineer?"
- No. 61-MD-7 "High-Strength Steels—Part I, Materials"
- No. 61-MD-8 "High-Strength Steels—Part II, Design and Fabrication"
- No. 61-MD-9 "Electric Motors at Higher Temperatures for Industrial Usage"
- No. 61-MD-10 "Mechanical Application of Non-Excited Synchronous Motors"
- No. 61-MD-11 "Design Considerations and Drafting Techniques for Production on Numerically Controlled Production Machines"
- No. 61-MD-12 "Cost and Value of Small Tolerances and Smooth Finishes"
- No. 61-MD-13 "Elastomeric Adhesives—Industry's New Tool"
- No. 61-MD-14 "Factors in Joint Design Using Adhesives for Metal Bonding"
- No. 61-MD-15 "Which Fastener Should We Choose?"
- No. 61-MD-16 "Designing with Powder Metallurgy to Improve Quality and Reduce Cost"
- No. 61-MD-17 "Filament-Wound Pressure Vessels"
- No. 61-MD-18 "An Introduction to Designing with Plastics"
- No. 61-MD-19 "Visco-Elastic Damping"
- No. 61-MD-20 "Effect of Misalignment on Tooth Action of Bevel and Hypoid Gears"
- No. 61-MD-21 "Molybdenum Disulfides a Lubricant"
- No. 61-MD-22 "Molybdenum Disulfides as an Additive to Improve the Performance of an Automotive Multipurpose Grease"

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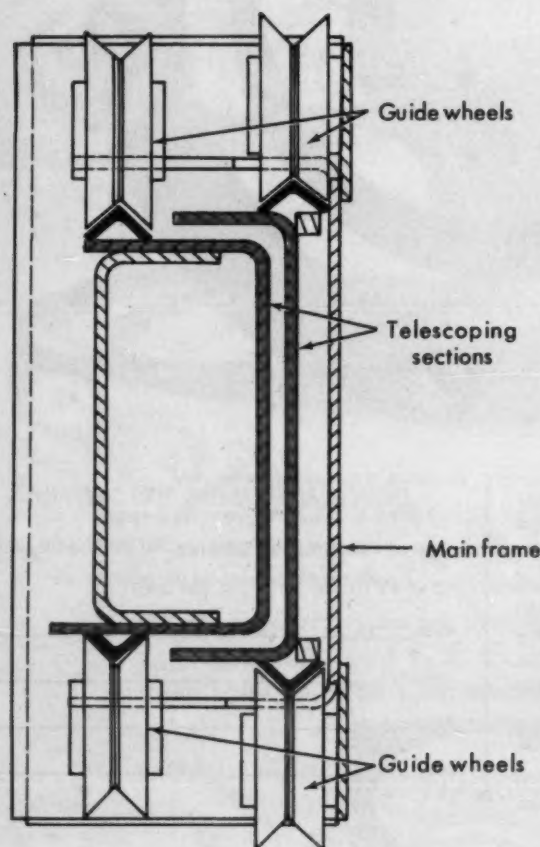
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## Concrete Finisher Uses Alternator for Infinite Speed Control

Gasoline Engine Generates A-C for Traction Drive, Hydraulic Pressure for Screed and Direct Power for Screed Operation

Lars G. Soderholm, Midwest Editor



**FEELER ROLLERS** keep finishing machine aligned with form and also compensate for changes in width. Each roller operates between two electrical switches. Any two closed contacts initiate some type of corrective action.

A new, self-widening concrete-finishing machine generates its own a-c current and obtains infinite traction speed selection through control of input speed to the alternator and control of two-speed squirrel-cage induction motors on the drive wheels. Telescoping box-type frame members are electrically powered to provide adjustments of width—even while in motion.

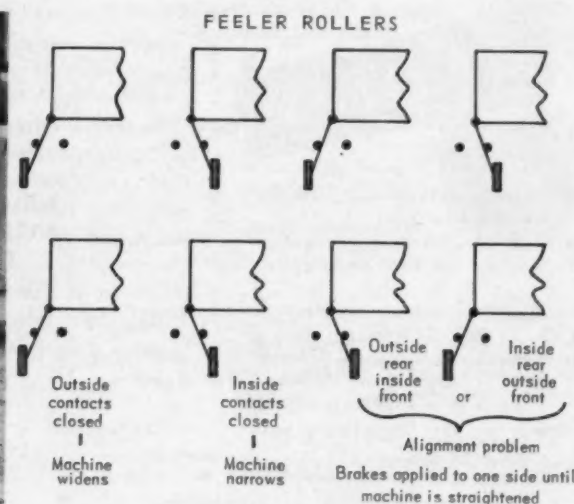
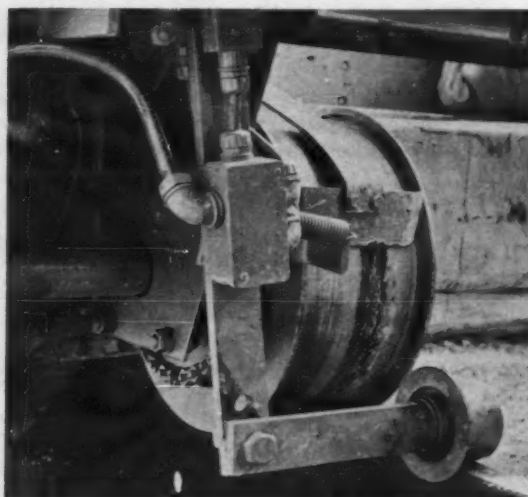
To provide better control characteristics, the designers of this finishing machine decided to use a-c power rather than the conventional d-c motors. A-C motors are self-compensating under load and eliminate racking and weaving of the machine on the forms. Additional advantages were gained since infinite control between speeds of 8 to 80 fpm were possible by varying the a-c frequency and by using two-speed traction motors. The alternator is connected to the engine through a variable-speed belt drive controlled from the operator console. A manual selector picks either high- or low-speed operation of the traction motors. The a-c motors, without brushes or other sensitive parts, require less maintenance than d-c motors.

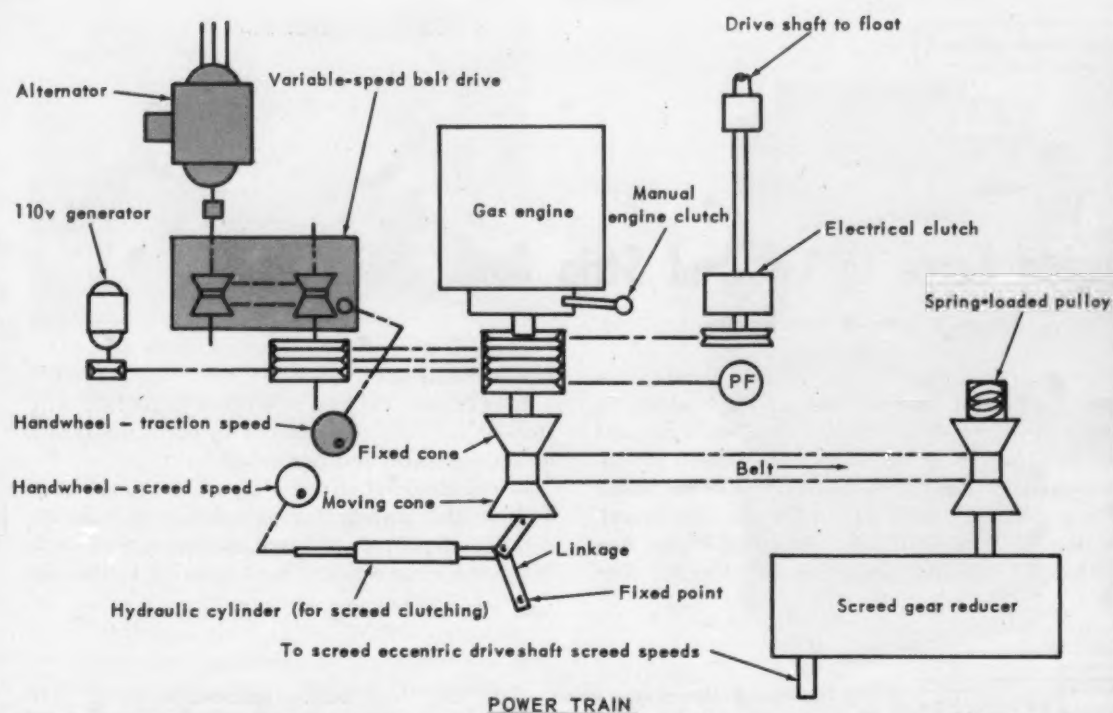
The 30-hp gasoline engine power source not only turns the alternator but also powers the screed

eccentric driveshaft through a clutch and variable-speed pulley combination. The variable-speed pulley also is regulated from the control console. In addition to the alternator, an a-c generator is used to provide 110v current for control functions and a convenience outlet. A hydraulic pump provides 1200-psi pressure for engaging the screed clutch, lifting front and rear screeds, and raising or lowering the transport wheels.

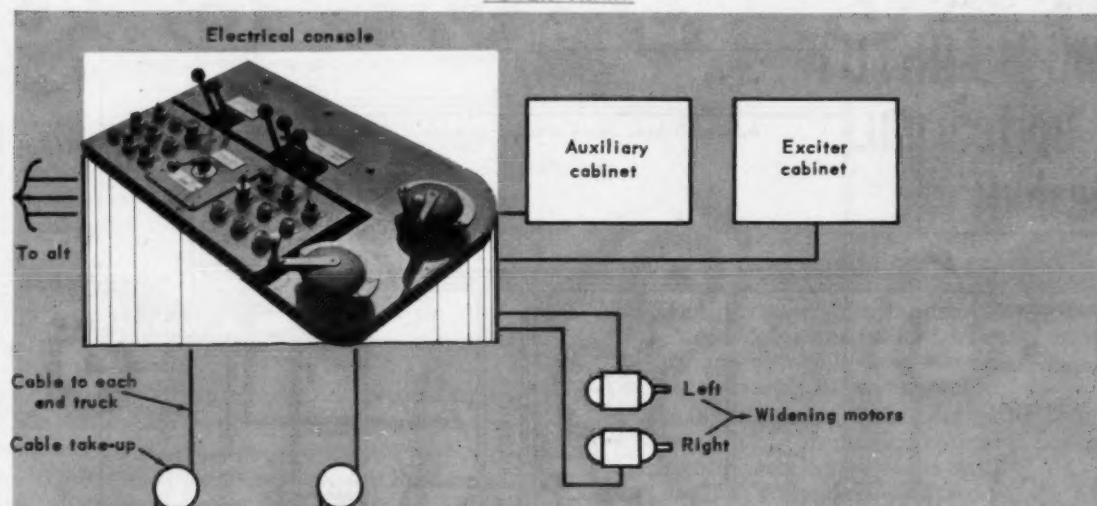
The most unusual feature of the finisher is its ability to adapt to different widths from 12 to 28 ft through push-button control. The adjustable box-type frame members telescope. Separate widening motors are used to extend the members, each in a different direction and independent of the other. Automatic widening and alignment can be secured by feeler rollers located to one side of the unit, one roller in the front and the other at the rear. The feeler unit keeps the machine at right angles to the form on which the feeler rollers are riding. It also adjusts the width of the finisher automatically to compensate for misalignment of the forms.

The Model SW-100 self-widening concrete finishing machine is made by the Blaw-Knox Construction Equipment Div., Mattoon, Ill.

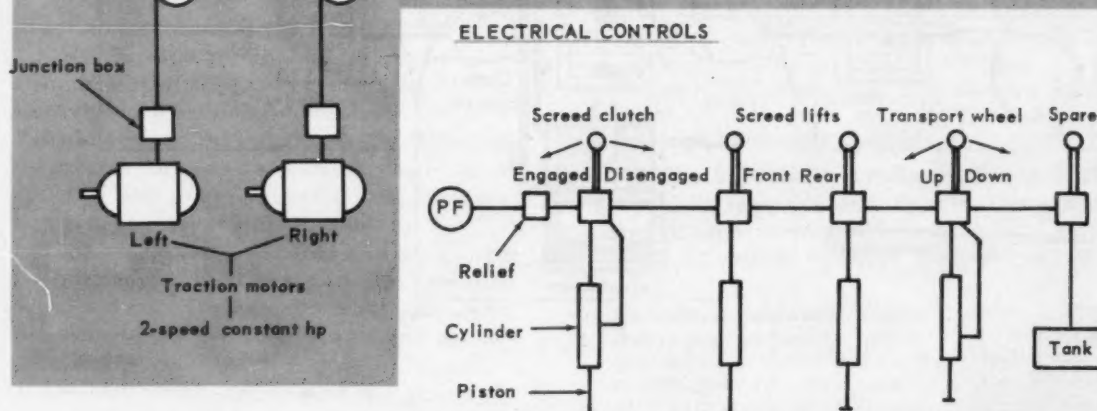




POWER TRAIN

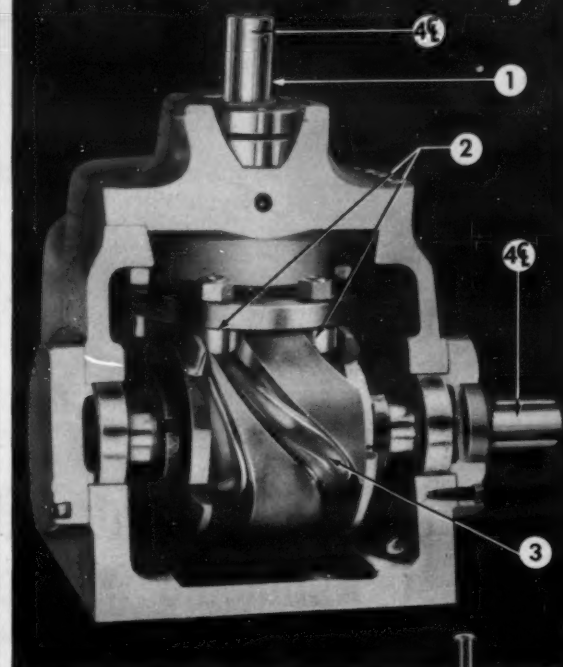


ELECTRICAL CONTROLS



HYDRAULIC CONTROLS

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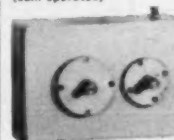


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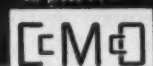
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## Two Pistons Double Force to Cut and Strip Coax Cable

Edward W. Schrader, Western Editor

Through the simple expedient of adding a second piston on the same rod, the cylinders of a wire cutter and stripper are modified to cut and strip coaxial cable. The pistons double the force to a new magnitude of 600 lb.

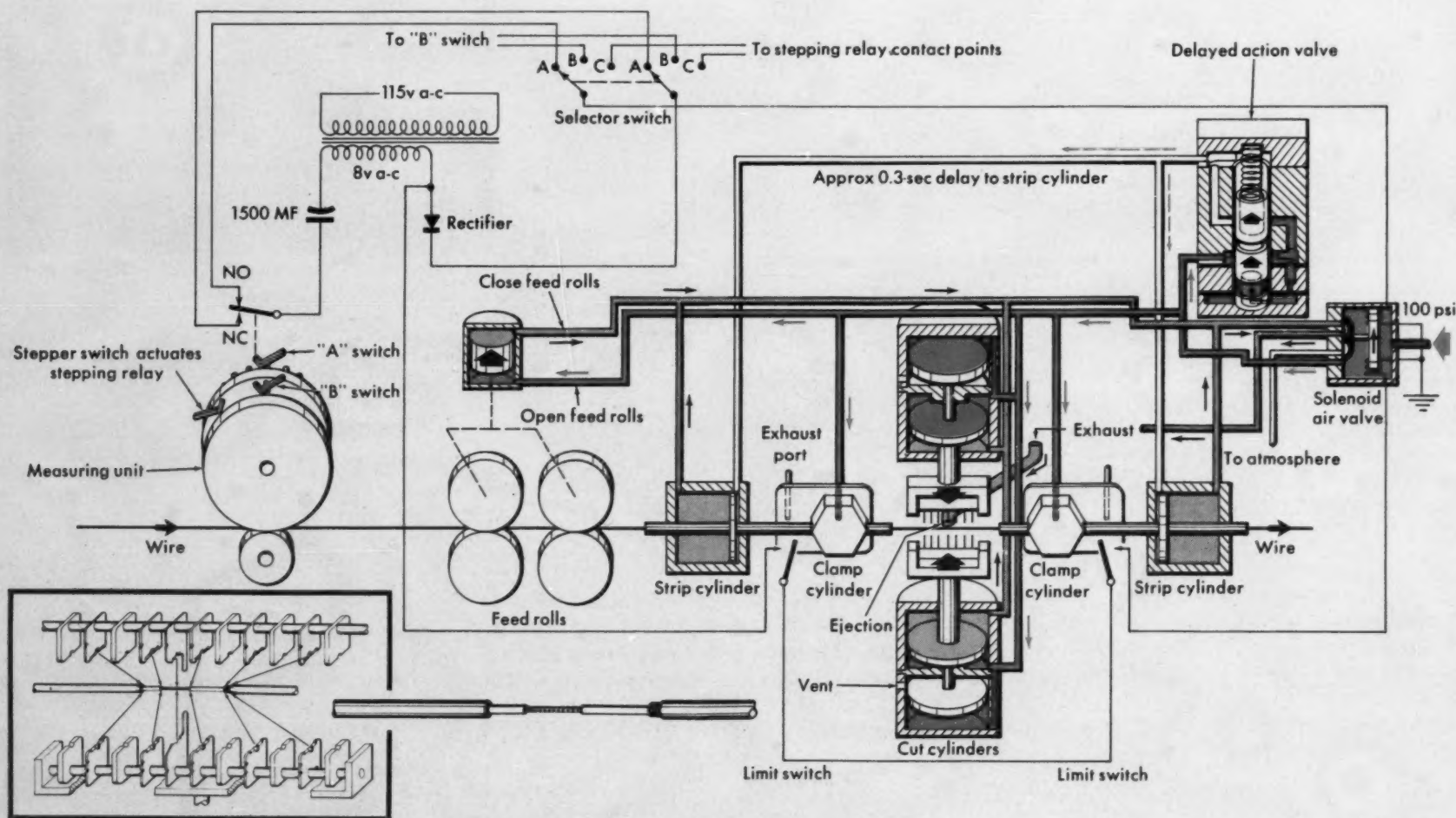
An intermediate cap replaces the standard cap on the cylinder. A stepped-diameter piston rod replaces the standard piston rod. The original, or in-

ner, piston on the rod lies between the standard-cut cylinder and the intermediate cap. The added, or outer, piston lies between the intermediate cap and the outer cap. A drilled vent hole between the intermediate cap and the lower position of the added piston minimizes back pressure against the second, or outer, piston. Otherwise, the entire system uses the same components for the standard model wire

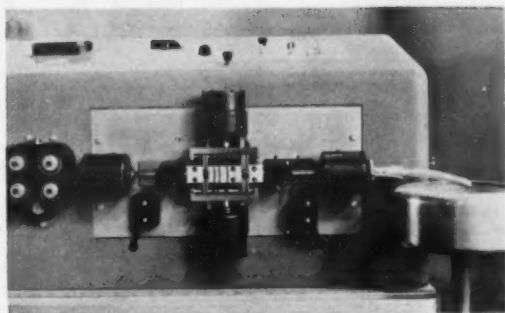
cutter and stripper.

In operation, the feed rolls rotate to pull the wire through the measuring unit. This unit consists of a measuring wheel and cam wheel.

In the electrical circuit a capacitor charges until a pin on the cam wheel opens switch A or B, whichever is in the circuit as chosen by the selector switch. When the selector switch is on position C, the cam



**DOUBLE PISTONS** at top and bottom of cut cylinders modify standard cutter and stripper to cut coaxial cable. Blade diagram shows spacers and dies for partial strip and cut of coaxial cable. Dies close on wire, at points shown, each time cut cylinders are actuated in system.



**COAXIAL CABLE CUTTER AND STRIPPER** is modification of standard unit. Blades travel in milled slots of strip block and are powered by double-acting cylinders both top and bottom. Strip lengths are changed by shifting blades.

pin striking the C switch steps a ratcheting relay. After six revolutions of the cam, and six steps on the ratcheting relay, the B switch is energized. On the next revolution, the pin striking the B switch discharges the capacitor. Whichever switch is tripped, the capacitor discharges through a solenoid air valve. This four-way, two-position valve supplies pressurized air to either raise or lower the cutting cylinders and to perform other operations such as opening and closing the feed rolls.

When the capacitor discharges, pressurized air opens the feed rolls, closes clamps against the wire, closes the cutter head and enters the delayed-action valve. After a momentary delay, the piston in the delayed-action valve shifts. This action permits compressed air to move the pistons in the strip cylinders and retract the clamp cylinders, thus removing the stripped insulation from the cut wire.

The clamp cylinders exhaust pressurized air through an exhaust port. A spring simultaneously returns the clamps, thus releasing the wire.

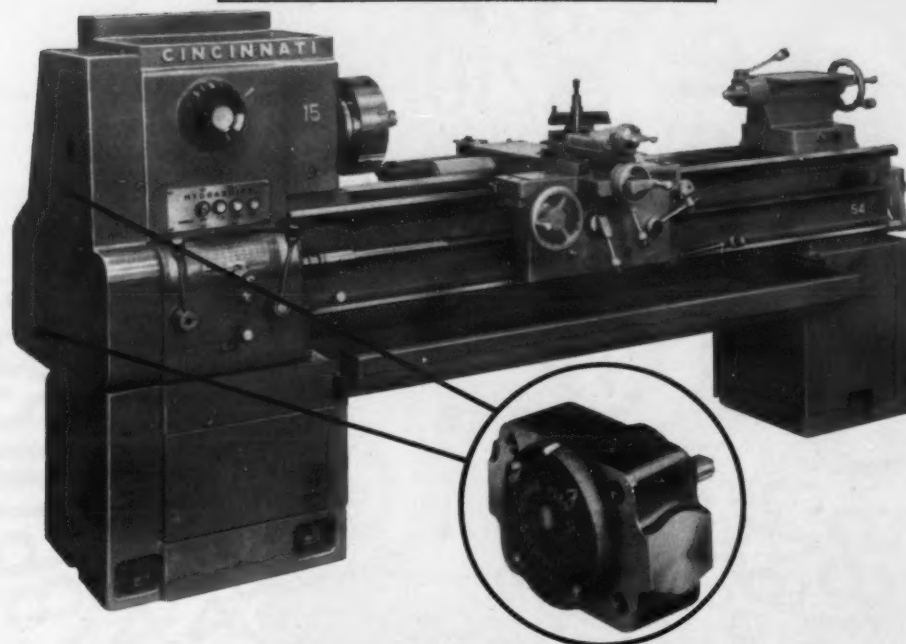
The clamp cylinders move to close limit switches whose signals cause the solenoid air valve to return to its original position.

With the two-way valve in the original position, pressurized air opens the cutter head. It returns the double pistons and closes the feed rolls. Exhaust air from the cylinders is forced through the exhaust port into a strip block where part of the air is used to eject stripping insulations and part is used to eject stripped wire.

The cycle repeats as the feed rolls again move the wire, which in turn rotates the measuring wheel and cam. The followers release one of the switches and the capacitor charges and another cycle begins.

The wire cutter and stripper is a design development of Eubanks Engineering Co., Pasadena, Calif.

Another pump problem . . . solved by TUTHILL



## TUTHILL PUMPS For Hydraulics, Lubrication in New Cincinnati Hydrashift Lathes

Cincinnati's new Hydrashift lathes use hydraulic power instead of muscle for spindle speed shifting. Entirely new from headstock to tailstock, these dependable units reflect in every way the quality and reliability long associated with this leading machine tool manufacturer.

Cincinnati selected Tuthill pumps for two vital assignments . . . to provide hydraulic power for Hydrashift preselective speed shifting . . . and for positive pressure lubrication of the entire unit. Minor modifications of a standard Tuthill cartridge pump, Series RFD, enable it to meet the requirements of both applications . . . providing interchangeability and allowing incorporation of both units with the greatest possible ease on Cincinnati's assembly line.

### Wide Selection Available From Stock

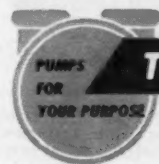
Tuthill's versatile and dependable cartridge pumps have been used for hundreds of applications . . . both as OEM components and for

maintenance. Their compactness solves design problems . . . for example the Model RFD above measures only 4 1/4" by 2 1/2" by 3 15/16" including shaft. Moderate prices and immediate availability from stock minimize inventory problems, result in significant savings.

Cartridge pumps can be supplied for capacities from 55 to 360 gph at 1800 rpm. They are available with or without Tuthill's special reversing feature which allows them to be driven from reversing shaft or for nondirectional service. They may be supplied with internal or external porting . . . or with variations of both. Three different standard shaft modifications are offered and many more are available.

Send today for Catalog 100 which gives complete details . . . or send information on your particular application so Tuthill's engineers can indicate ways in which a Tuthill pump can save you money.

*Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1 to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.*



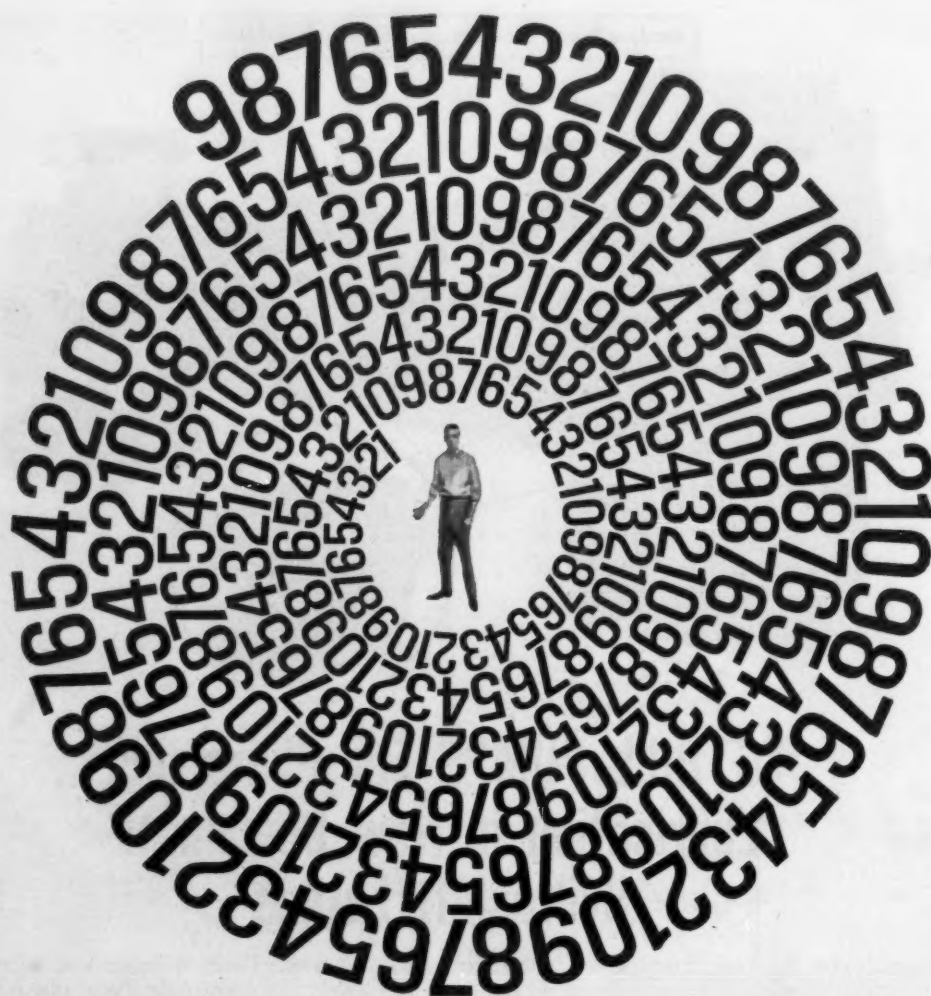
**TUTHILL PUMP COMPANY**

943 East 95th Street, Chicago 19, Illinois

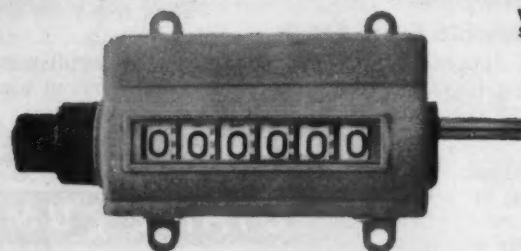


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Now numbers big enough to see at 20 feet . . . on the Veeder-Root Visicounter! No squinting, no stretching with the new Visicounter. This counter, with larger than ordinary figures, provides easy read out for difficult-to-see locations. And, no matter how hard your machinery jiggles or punches, the Visicounter goes right on scoring because it's built to take it. Whether you're designing new machines or boosting efficiency of present equipment, you'll find that it pays to check into Visicounter. Write: Mechanical Section, Veeder-Root Incorporated, Hartford 2, Conn. count on...Veeder-Root



Visicounter is available in ratchet types, with speeds up to 500 counts per minute, or in geared types with up to 1,000 counts per minute. The new figures, larger and sharper, are another example of Veeder-Root design for maximum efficiency.

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Visit Booth 243 at the Design Engineering Show, Cobo Hall, Detroit, May 22-25

## IDEAS...CONTROLS

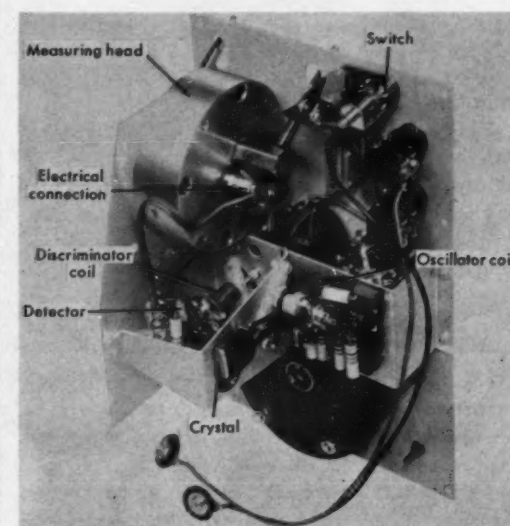
### Pressure Alters Condenser

Robert L. Candlish, Detroit Editor

An ultrasensitive micromanometer capable of measuring differential gas pressure down to  $\pm 0.00016$  inch of water has as a measuring head two symmetrically arranged cavities separated by a metal diaphragm and two fixed electrodes. These form two condensers which are part of the tuning capacities of two tuned circuits. Both are equally coupled to an RF oscillator. Movement of the diaphragm causes a variation in the capacitance between it and each adjacent electrode. This difference in capacitance is measured and displayed on a panel meter. The meter is calibrated directly in pressure units.

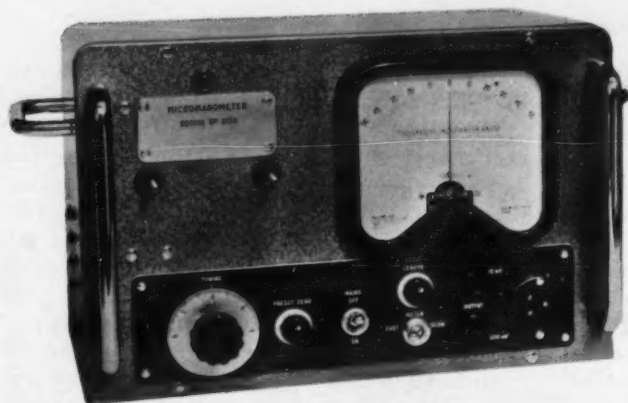
The considerable sensitivity of the instrument permits very accurate measurement of flow in pipes without the use of orifices or venturi tubes by using the manometer to measure the pressure drop in the pipe itself. A steady pressure difference between two points can be measured by using tubing as small as 1.0 mm in dia with leads up to 20 ft long per side.

The I.R.D. Electronic Manometer is a development of the Gelman Instrument Co., Chelsea, Mich.

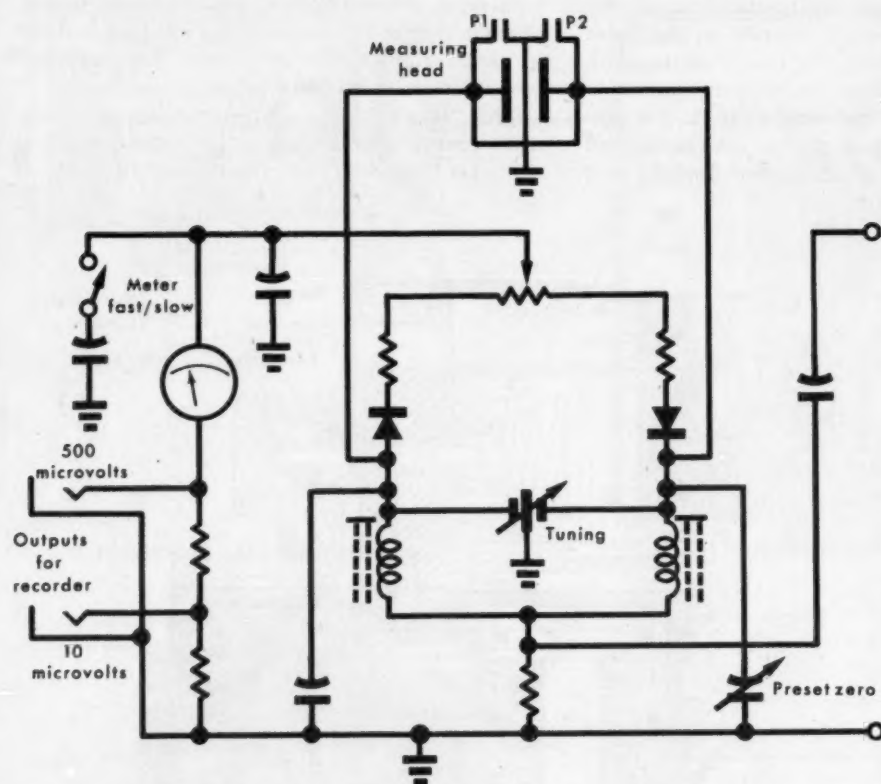


MEASURING HEAD will withstand static working pressures of 1000 psi and differential overloads up to 10 times full-scale pressure. Heads will respond to sine-wave pressure variations up to 200 psi. Connectors for flexible tubing on front of instrument conduct pressures to measuring head.

## Capacitance in Electronic Manometer

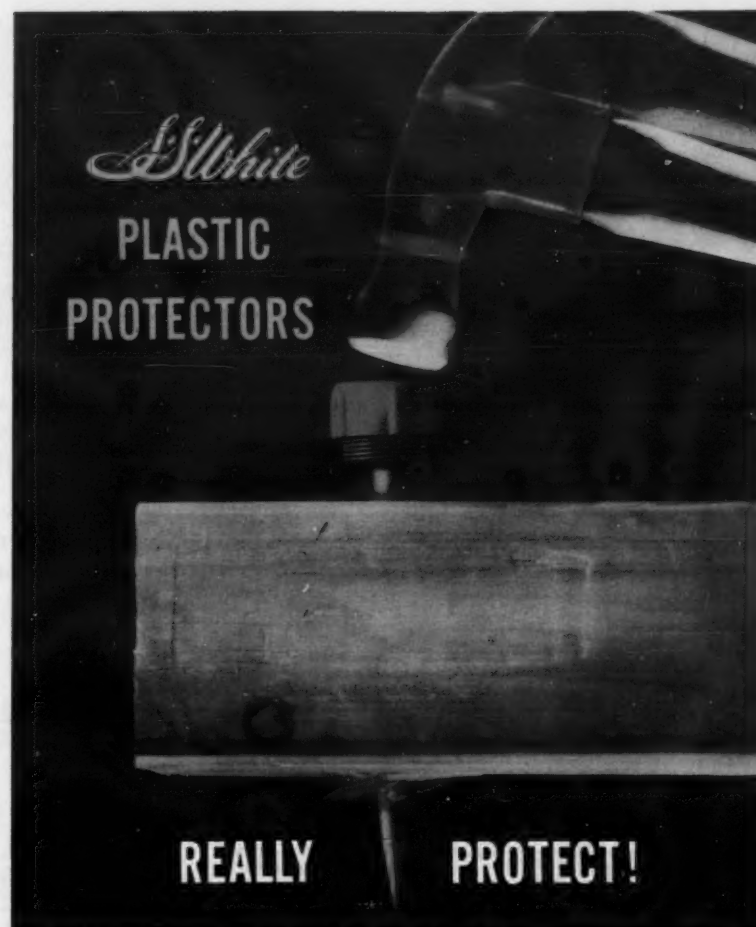


**FULL-SCALE READING** indicates differential gas pressure of 0.004 inch of water. Scale is linear, permitting pressures down to  $\pm 0.00016$  inch water gage to be measured. Optional measuring heads permit reading pressures to  $\pm 10.0$  inches water gage. Instrument operates in 110v a-c.



**VARIATION OF MANOMETER CAPACITANCE** to either electrode, by movement of diaphragm, unbalances RF voltages on two tuned circuits and operates differential valve voltmeter. Sensitivity of electronic circuits can be adjusted so alternative heads will measure exact multiples of pressures shown on meter. Jack

is provided for external recorder. Oscillograph recorder can be used to take advantage of high speed of measuring system. Switch is provided to increase time constant of measuring circuit to 0.3 sec. In this manner, relatively steady readings can be obtained for pressures fluctuating rapidly about mean value.



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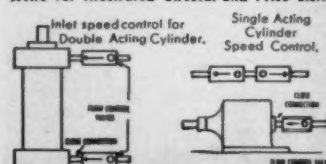


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## IDEAS... CONTROLS

## Internal Accumulator Powers Pilot Shift

Lars G. Soderholm, Midwest Editor

A redesigned, four-way, directional pilot-operated pneumatic control valve uses an internal accumulator chamber to store energy for pilot operation—even if there is a severe pressure drop in the system. Response time and reliability are improved since the previous spool-type pilot is replaced by a short-stroke, poppet-type pilot.

Operating reliability was improved over that of the earlier model by incorporating an accumulator chamber inside the valve body to insure enough air for complete shifting of the pilot spool in case the pressure were to drop because of demands elsewhere in the system. In addition, a self-compensating poppet-type pilot offers more consistent performance over the former spool-type pilot with O-ring seals.

The improved response time resulted from shorter stroke pilot, lighter weight poppets in the valve body and the smaller load now placed on the pilot.

The previous directional control valve was made of bronze sand castings and weighed 18 lb. The new valve is made of aluminum shell or die castings and weighs only 6 lb. The old valve used dynamic seals

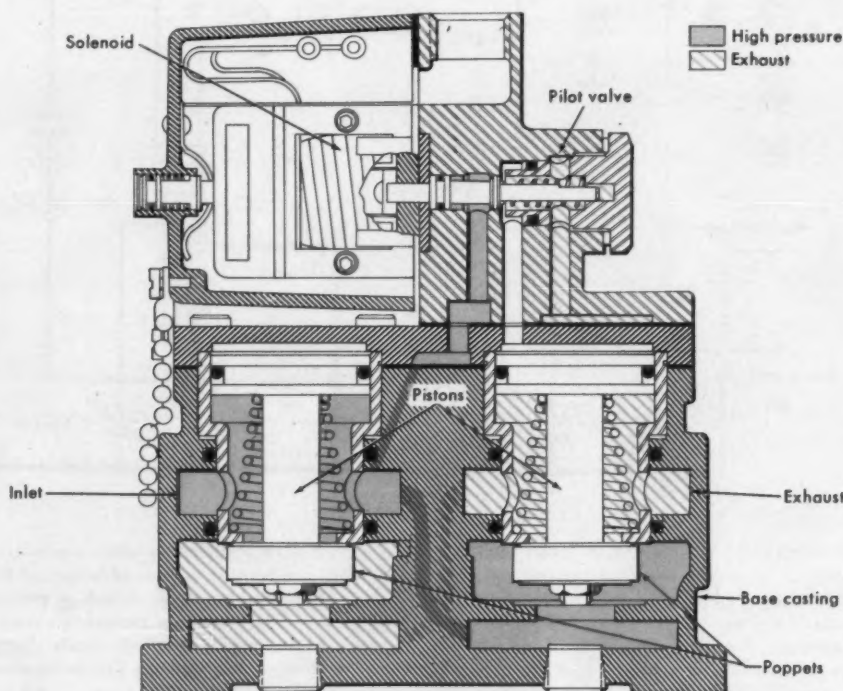
of "Buna-N" rubber while the new valve uses "Viton" seals that are not sensitive to hydraulic fluids.

The old valve coil at 115v, 60 cycles had an inrush current of 1.6 amps and a holding current of 0.24 amp. The new coil, which is smaller and entirely encapsulated in nylon, has an inrush current of 0.24 amp, a holding current of 0.14 amp and will not burn out under full inrush current. The nylon capsule over the coil acts as a bearing for the pilot valve plunger. Molded spines in the core also provide builtin air passages around the pilot plunger.

Air-handling capacity of the redesigned valve provides a  $C_v$  of 3 against a  $C_v$  of 4.5 for the old valve. Response time of the new 1/2-inch-dia valve to fill a 12-cu-in test chamber from 0 to 90 psi and to exhaust from 100 to 10 psi, as measured from instant of energizing or de-energizing the solenoid, is 0.029 sec to fill and 0.04 sec to exhaust. The old valve took 0.046 sec to fill and 0.085 sec to exhaust.

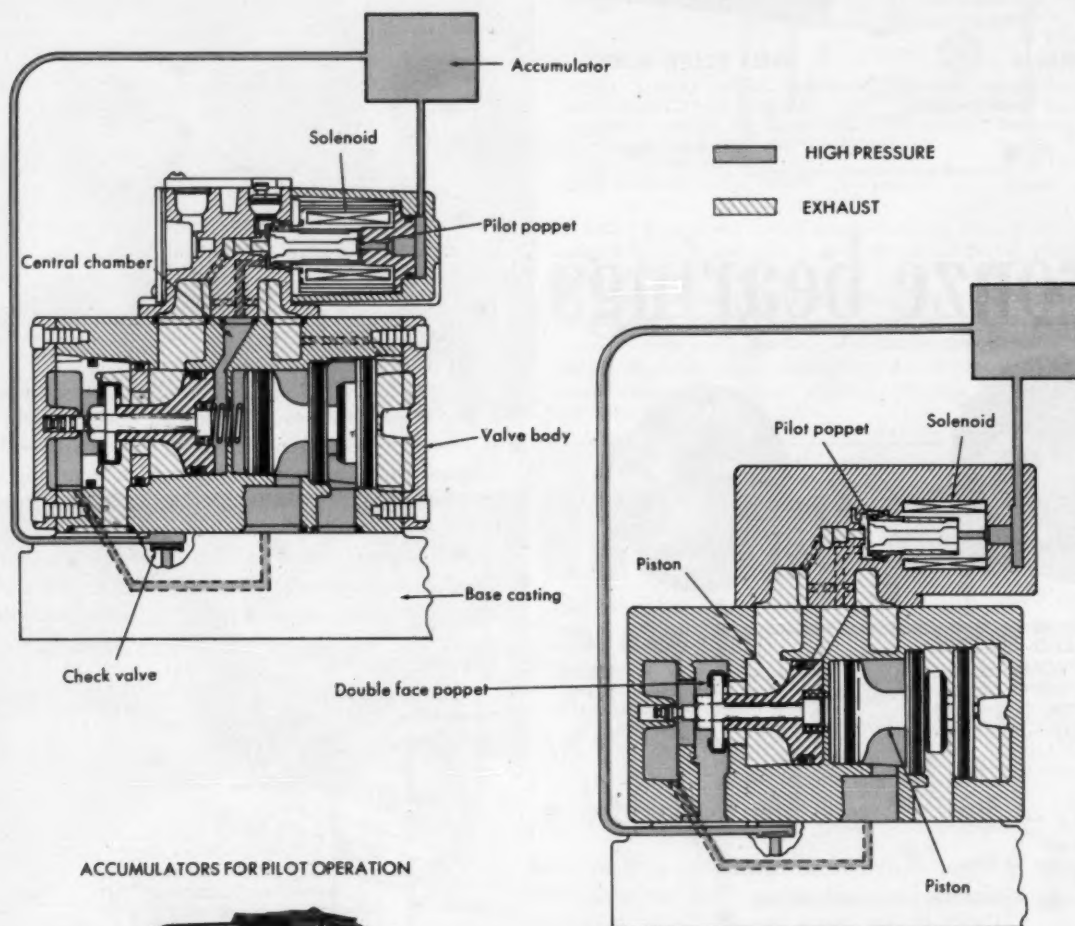
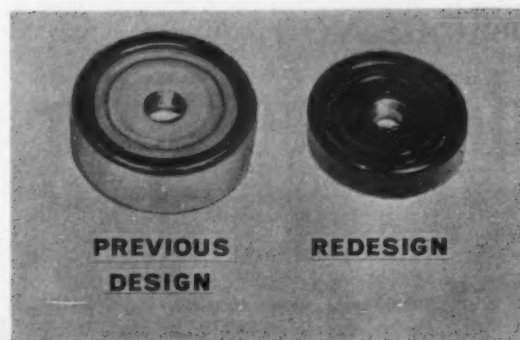
The "Hustler" four-way, pilot-operated, pneumatic control valve is made by Hannifin Co., a Div. of Parker-Hannifin Corp., Des Plaines, Ill.

**PREVIOUS VALVE DESIGN** in de-energized position places pilot valve spool so area above two pistons is open to exhaust side of system. Both piston-poppets are then held in up position by internal pressure. When solenoid is energized, pilot valve shifts to admit pressure over both pistons, forcing both poppets to move down into lower seats in valve body. This reverses pressure in chambers and changes pressure relationships in cylinder ports.

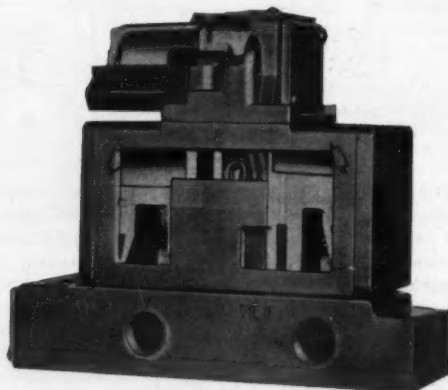


## in Redesigned Air Valve

MEMBRANE-TYPE SEAL uses O-ring contour. New lightweight poppet is compared with previous poppet design.

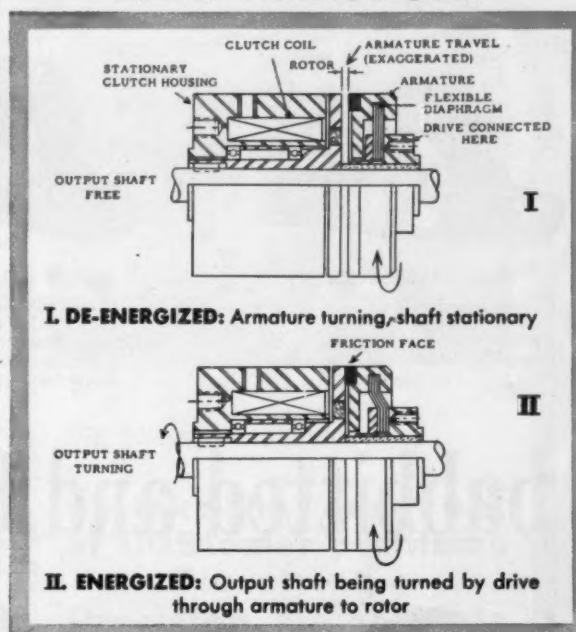


ACCUMULATORS FOR PILOT OPERATION



**REDESIGNED VALVE** operates in de-energized position with inlet air pressure forcing piston poppets outward against flat sealing surfaces. Inlet air reaches central chamber by passing through check valve, accumulator chamber and into area behind pilot poppet. Pilot plunger in forward position allows air to pass between it and nylon coil casing and into central chamber. When solenoid is energized, pilot plunger moves back, shutting off inlet air from accumulator chamber. This also opens central chamber to exhaust side of system. Both piston poppets shift inward against opposite sealing faces to reverse pressures in cylinder ports.

## Choose A Diaphragm Electric Clutch for Superior Performance Lower Installed Cost



Like most really sound engineering ideas the practicality and economy of electric clutches and brakes without the conventional sliding armature had to be proved in practice.

Now, a few short years after their introduction, Simplatrol electric clutches and brakes have proved that their design, based on a flexible diaphragm in the clutch's armature, does do a better job than armature plates sliding on splines, pins, or hubs.

Simplatrol's armature, a one-piece assembly, deflects to perform clutching or braking action. Wear is reduced to vanishing point since there are no sliding parts to contact each other; instant performance is achieved without slow release, or "hanging up."

This Simplatrol diaphragm principle ensures smoothness, quietness, and consistency.

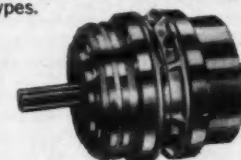
Compare the installed cost.

Simplicity carries through to the installation, reducing cost here as well. You simply slip one of the 2 or 3 major assemblies onto the shaft — that's all the assembling you do! No pins, no nuts, no washers, no springs to run up labor cost.

Machined parts in the clutches and brakes are of uniform quality. There's close built-in control of tolerances and finishes . . . and the assemblies are pre-burnished! All clutches include bearings, machined surfaces and bolt holes for direct mounting of your drive unit.

Simplatrol offers a complete range of diaphragm electric clutches from torque of 10 ounce inches to 470 pound feet in diameters from 7/8" to 12 1/2". Styles include clutches, brakes, clutch-brakes, duplex clutches, and couplings in both rotary and fixed field types.

Ask Simplatrol's sales engineers to demonstrate to you specifically how the unique advantages of flexible diaphragm performance will benefit your operation.

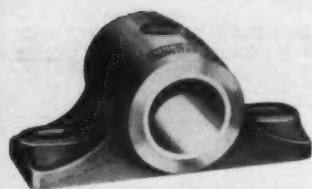


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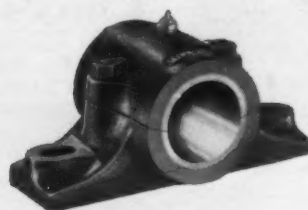


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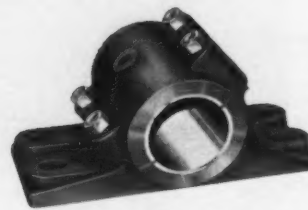
## SOLID PILLOW BLOCKS

Gray iron housings, babbitted or bronze bearings—or plain bored bearings; for  $\frac{1}{2}$  to  $2\frac{1}{16}$ " shafts.



## SPLIT PILLOW BLOCKS

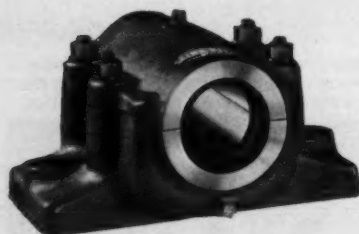
Split and split-gibbed types; gray iron or cast steel housings; bronze or babbitted; 2-bolt for  $\frac{1}{2}$  to 3" shafts; 4-bolt for  $1\frac{1}{16}$  to 12" shafts.



## ANGLE PILLOW BLOCKS

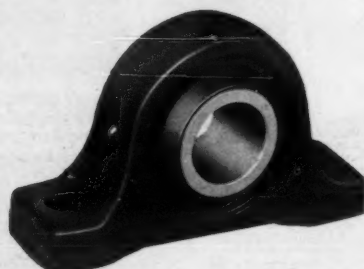
For heavy angular loads; split gray iron housings; babbitted or bronze bearings; 2-bolt for  $\frac{1}{16}$  to  $2\frac{1}{16}$ " shafts; 4-bolt for  $1\frac{1}{16}$  to 9" shafts.

# babbitted and bronze bearings



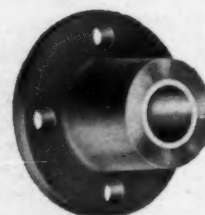
## RING-OILING PILLOW BLOCKS

Split housings; babbitted bearings; self-lubricating; 2-bolt for  $\frac{1}{16}$  to  $2\frac{1}{16}$ " shafts; 4-bolt for  $1\frac{1}{16}$  to  $3\frac{1}{16}$ " shafts.



## FLEX-BLOCK SLEEVE BEARINGS

Self-aligning, self-lubricating, with sleeves to suit various operating conditions; pillow and flanged block types; for shafts from  $\frac{3}{8}$  to  $3\frac{1}{16}$ ".



## FLANGED BLOCKS

Solid gray iron housings; babbitted bearings; 4-, 6- or 8-bolt flanges with machine-finished faces; for  $\frac{1}{16}$  to  $5\frac{7}{16}$ " shafts.

Over 15 types, more than 350 sizes . . . and all these features besides!

- **DURABLE, COMPACT HOUSINGS** of cast gray iron or cast steel provide exceptional strength where needed, without excess size or weight.
- **PRECISION-MACHINED BORES** provide correct running clearance between shaft and bearing metal for load carrying oil or grease film.
- **STURDY BEARINGS** of heavy-duty babbitt or high-quality bronze are anchored in housing.
- **ACCURATELY MACHINED BASES** assure firm seating on supports.
- **FINISHED ENDS** permit flush mounting of sprockets, pulleys, wheels and collars against bearings.
- **SHIMS** between cap and base of split housings provide shaft clearance adjustment, compensate for wear.
- **SLOTTED BOLT HOLES** in bases allow easy adjustment for shaft alignment.
- **RELIABLE LUBRICATION**—Holes for grease cups or pressure fittings are drilled and tapped. Grooves distribute lubricant over entire shaft surface. (Flex-Block and ring-oiling types are self-lubricating.)
- **OFF-THE-SHELF DELIVERY** is offered by Link-Belt on over 15 types and more than 350 sizes of babbitted and bronze bearing pillow and flanged blocks . . . for commercial shafting up to 12" diameter. Also immediate delivery on takeups in all popular sizes.

For complete information, contact your nearest Link-Belt office. Look under **BEARINGS** in the yellow pages of your telephone book. Ask for Book 2707 and Folder 2823.

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**LINK-BELT COMPANY:** Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarborough (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

## IDEAS . . . CONTROLS

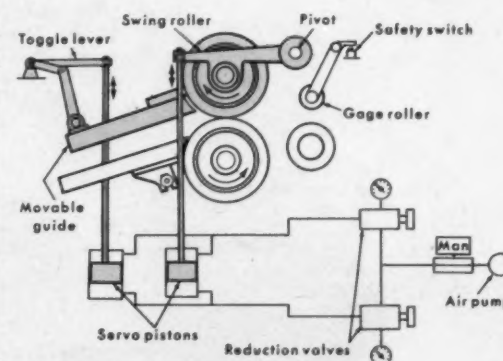
## Actuating Air Cylinders

Celestino O. Lubatti, Italian Editor

Differential pressure from two reduction valves, applied to two double-acting cylinders, forms an adjustable air-suspension and lifting mechanism for the swing roller of a cloth fuller mill. Use of variable air pressure eliminates springs, permits accurate adjustment of fulling pressure and eliminates the need for a separate roller-lifting servo.

The adjustable reduction valves pass different pressures to each side of two parallel servo pistons. Resulting forces increase or decrease the effective weight of the swing roller and its suspension linkage. One piston rod is hinged directly to the swing roller arm; the other is connected to the movable delivery guide by a toggle lever. Air pressure acts simultaneously on both pistons, allows swing roller and movable guide to oscillate independently when pleats or other changes in cloth thickness pass.

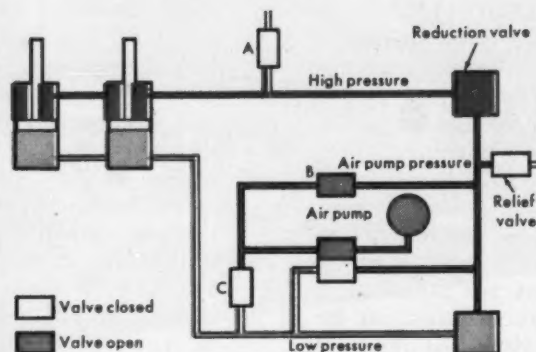
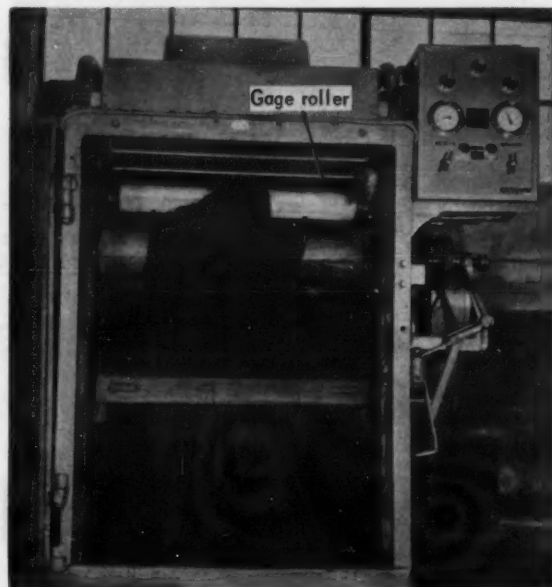
A gage roller before the fulling rollers detects knots or excessive cloth folding and opens a safety switch for emergency stop. Current switch-off releases three solenoid valves which vent high pressure from the air pump to promptly lift swing roller and allied parts. The pneumatic control, a design development by Mechanische Automation Textil, Verolanuova (Brescia), Italy, reduces human attendance and permits higher fulling speed.



**MOVABLE GUIDE** pivots about swing roller shaft and hangs on air-sprung toggle lever. Independent suspension of swing roller and movable guide prevents influence of outgoing pleats upon fulling pressure. Pneumatic system improves suspension response and also permits 200-230 meters-per-minute (658-820 fpm) fulling speed when low strength cloth is being processed. Gage roller prevents operator's hands from entering between fulling rollers and stops machine in case of emergency.

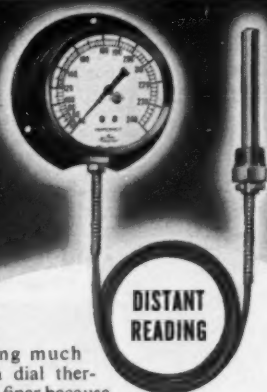
Circle 199 on Reader-Service Card for more information

## Double as Suspension for Roller



CURRENT in motor circuit during fullering keeps solenoid valves A-B closed and valve C open. Pressure from air pump enters adjustable reduction valves to set up differential pressure. When current is turned off, either by safety or by panel switch, valve C shuts off passage to reduction valves; air-pump pressure enters lower chambers of cylinders through valve B and discharge air escapes through valve A. Before restarting, air is released from lower chambers through double-valve and relief valve.

## The dial thermometer at its best



Something much finer in a dial thermometer: finer because it is the bourdon tube type of thermometer at its best...embodies the greater precision and lasting accuracy of the Marsh Pressure Gauge.

Both vapor tension and gas-filled types are available in either distant reading or rigid stem types. In the broad Marsh line you have a complete selection of temperature ranges, case sizes, styles, and finishes.

Ask for the Thermometer Catalog

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MARSH INSTRUMENT COMPANY, Dept. 38 Skokie, Ill.  
Division of Colorado Oil & Gas Corporation  
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada, Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas, Eastern Seaboard Warehouse: Marsh Instrument Co., 1208 Anderson Ave., Fort Lee, N.J.

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## GRC tiny parts

Die Cast  
ZINC ALLOY  
Molded  
PLASTICS



Die Cast Zinc Alloy



Molded Nylon, Delrin & Other Engineering Thermoplastics



Coil Bobbins



Gears & Pinions



"SMALL ZINC ALLOY DIE CASTINGS" Fact-filled booklet contains helpful designer's check list, exclusive GRC methods to help you create new products at substantial savings.

GRC's unique high speed, automated methods give you high quality, uniformly accurate small parts in die cast zinc alloy or molded Delrin, Nylon and other engineering thermoplastics...at low cost. GRC experience and exclusive techniques open the way to new design freedom, new production and assembly short-cuts. Write, wire, phone NOW for samples and detailed bulletins. Send prints for prompt quotation.

NO MINIMUM SIZE! Maximum sizes:  
Zinc Alloy—2" long, 1/2 oz.  
Plastic—1 1/4" long, .03 oz.

See us at the DESIGN SHOW  
Booth #1143

**GRIES REPRODUCER CORP.**  
World's Foremost Producer of Small Die Castings  
135 Beechwood Avenue, New Rochelle, New York • NEW Rochelle 3-8600

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Mr. Design Engineer:

**we take the "cuss" out of CUSTOMER problems involving Precision Metal Parts**

AERO GASKET... experienced at solving tough assignments for design engineers... is especially organized for custom designing and manufacturing precision metal parts — including stampings and machined parts. AERO GASKET can produce precision metal parts made of any metal and with any finish presently available.

AERO GASKET welcomes the challenge of difficult jobs involving precision metal parts... or molded parts, diaphragms, diaphragm assemblies, seals and gaskets. SEND PRINTS AND DETAILS FOR PROMPT QUOTATIONS.

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☐ Please send me the Data Sheets describing Aero Gasket Precision Metal Parts.

I am also interested in:

☐ Precision Molded Parts ☐ Seals and Gaskets  
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**THE AERO Gasket CORPORATION**  
Meriden, Connecticut

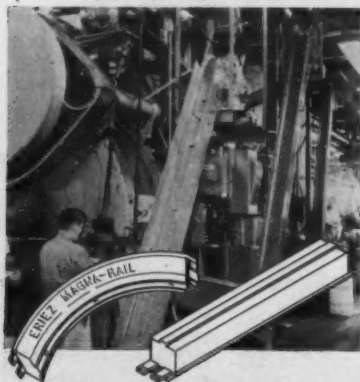
DIAPHRAGMS • ACTUATORS • ACCUMULATORS  
METALLIC & NONMETALLIC GASKETS  
CLAMPS OF ALL TYPES AND DESCRIPTIONS  
MOLDED RUBBER PARTS • METAL  
STAMPINGS • METAL-TO-RUBBER  
BONDING

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## ERIEZ Magnetic Minute

60 seconds that will help you improve operating efficiency.



### HOW TO BUILD A PLUS into PLANT AUTOMATION systems

You can often boost the sales appeal and value of your equipment by incorporating Eriez Magnamation® (magnetic automation) components.

For example — Eriez Magna-Rails fastened under conveyor belts provide safe, positive hold of ferrous parts. They swiftly convey, control, and elevate parts up or down inclines as steep as 90°; increase safety and reduce damage by preventing slippage; save valuable floor space by permitting shorter belt spans and closer grouping of machines.

Magna-Rails are available with or without extruded aluminum covers — in 3 standard strengths and increments of up to 8' in any one section. Assembly width is 4".

Eriez broad experience with OEMs, designers and direct users is available to assist you in the application of magnetic components to materials handling equipment. Write to:

**ERIEZ MANUFACTURING CO.**  
200SA Magnet Drive, Erie, Pa.



**MAGNA-THOUGHT**  
By using exactly the right magnetic material for a given application, Eriez can provide each customer with precisely the right equipment to do a particular job.

*W. J. Faller*  
W. J. FALLER  
Product Mgr. Automation



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## NEW BOOKS

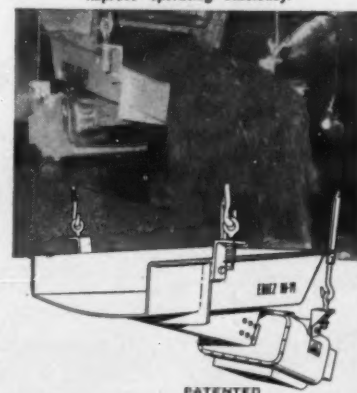
**NUMERICAL METHODS FOR SCIENCE AND ENGINEERING.** An outgrowth of lectures in numerical methods given within the engineering-physics curriculum at the University of Toronto, this volume is a text book rather than a work of reference. It is intended for students with the usual engineering background, including the usual courses in differential and integral calculus. The author, Ralph G. Stanton, stresses groundwork and fundamentals rather than sophisticated solutions. He shows more than 100 solved numerical examples. A review of generally-used formulae starts the work. The author then goes into ordinary finite differences and divided differences, then shows specific examples of the Bessel Formula and the Everett Formulae. A chapter is devoted to the solution of linear equations and to iterative methods of solution. The concluding chapter leads to actual programming of problems for a digital computer, but all other chapters can be handled with slide rule or disc calculator. Prentice-Hall, Inc., Englewood Cliffs, N. J.; 266 pages; \$9.

**KINEMATICS AND LINKAGE DESIGN.** An understanding of the fundamental ideas of linkage design is stressed in this text by a recognized authority in the field of linkages. The author starts with an introduction to the four-bar mechanisms, reviews the velocity and acceleration analysis of plane motion, and continues with more detailed analysis of specific linkages. A total of 73 selected problems and their solutions is used as illustrations. Throughout the book the analysis of four-bar linkages is stressed. Higher mathematics are not required for a thorough understanding of the subject matter. By Allen S. Hall, Jr., Prof. of Mechanical Engineering at Purdue University. Prentice-Hall, Inc., Englewood Cliffs, N. J.; 162 pages; \$8.50.

**INTERNATIONAL TRANSISTOR SUBSTITUTION BOOK.** Represents a painstaking effort to serve the electronic industry with accurate, reliable transistor substitution information. Selections listed within the 64 pages are based on a critical, detailed examination of the electrical characteristics of original transistor as well as suggested transistor substitute. Keats A. Pullen, Jr., Eng. D., fully capable of doing so, examined the electrical specifications of transistors manufactured in the U. S. and six foreign countries. After holding the comparison to a very close tolerance, he made the selection of suitable substitutions. Collector power dissipation, frequency cutoff, collector-base breakdown voltage, collector current and alpha as well as beta ratings were the parameters used for comparison. Possible substitutes which were of doubtful character were omitted from the listing. This was deemed the only safe thing to do in order to protect against possible damage to the substitute transistor and perhaps related equipment. Where a substitute was usable, but only after consideration was given to one or more of the transistor operator parameters, these pertinent parameters are indicated in association with the suggested substitute. Such information safeguards the user of the guide book in the selection of the substitute as well as saving time by pointing up the variables which may be determined in order to allow the substitution to be used. Special effort was made to correlate the transistor type numbers no longer in general use with standard EIA numbers presently used. This takes care of the needs of the individual who may have occasion to find a substitute for a transistor identified by an old, no longer used type number. This is a typical informative Rider publication. John F. Rider Publications, Inc., 116 W. 14th St., New York 11, N. Y.; \$1.50.

## ERIEZ Magnetic Minute

60 seconds that will help you improve operating efficiency.



### HOW TO BUILD A PLUS INTO HEAVY-DUTY MATERIALS HANDLING EQUIPMENT

If the problem is feeding large tonnages of bulk materials with accurate control, consider including Eriez patented heavy-duty vibratory feeders in your new designs for materials handling equipment.

No rectifier is needed with Eriez AC powered feeders. Totally enclosed electro-permanent magnetic drive is ideal for hazardous, dusty, wet, and corrosive installations. New fibre glass springs assure superior performance and control . . . longer life because spring breakage is practically eliminated. Heavier, more rugged construction withstands severe operating conditions. Simple, compact controls require less wiring and installation time.

Illustration shows one of a number of Eriez units available for heavy feeding applications where big capacity and accuracy are essential. Eriez Hi-Vi® vibratory feeders include models with feeding capacities ranging from ounces to many tons per hour.

Write for descriptive bulletin to:

**ERIEZ MANUFACTURING CO.**  
200SB Magnet Drive, Erie, Pa.



**MAGNA-THOUGHT**  
Companies using Eriez components know we will remain faithful suppliers — not potential competitors.

*R. F. Merwin*  
R. F. MERWIN  
President



Circle 204 on Reader-Service Card

ROCKET DEVELOPMENT in the U. S. has brought a new science and a new branch of engineering into being; launched a new industry, and, without a doubt, changed the future course of human history. The name of a great American scientist, Dr. Robert H. Goddard, is still virtually unknown. Yet from 1909 until his death in 1945, his experiments and test flights did more to advance the development of rocketry than those of any other man in past or present history, since the invention of the rocket more than 700 years ago by some unknown Chinese. This 222-page diary of the space-age pioneer reveals a compilation of Goddard's own writing and his most significant experiments during a 12-year span, 1929 through 1941. Edited by Esther C. Goddard and G. Edward Pendray. Prentice-Hall, Inc., Englewood Cliffs, N. J.; \$2.45.

(Editor's note: The "man who ushered in the space age" received 83 patents on his rockets and space ideas. Today it is nearly impossible to design, construct or shoot a rocket without infringing a Goddard patent.)

ANALYSIS AND DESIGN OF MECHANISMS. While intended as a first-year text in mechanisms, this book can easily form a good reference source on basic mechanisms. The author starts with very basic explanations of motions and displacement, takes up velocity and acceleration and inserts a chapter on the graphical analysis of motion. An unusually good explanation of gearing and gear problems is included in Chapter 6. Linkages and cams are the final two chapters. By Deane Lent; Prentice-Hall, Inc., Englewood Cliffs, N. J.; 328 pages; \$9.35.

Circle 205 on Reader-Service Card

Planning  
a model change?

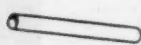


Time for your next model changeover, or a last minute change in your current model? Experience shows that tubing problems are usually solved best by tubing experts such as H&H Tube and Manufacturing

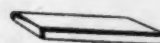
Company, Detroit. Over thirty years of experience in the design and the application of brass and copper tubing makes H&H a good firm to call for such assistance, especially when the problem is a tough one.

**H & H TUBE AND MANUFACTURING CO.**

271 North Forman Avenue, Detroit 17, Michigan • Offices from Coast to Coast



SEAMLESS



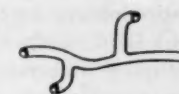
LOCKSEAM



COIL STRIP



STRAIGHT AND COILED TUBE



TUBULAR PARTS

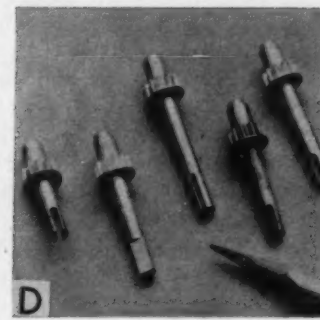
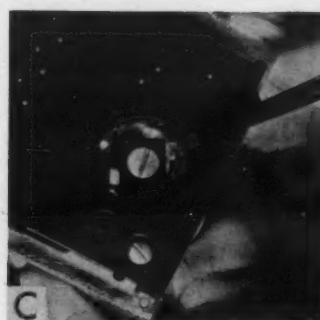
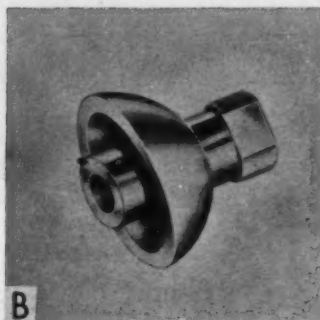
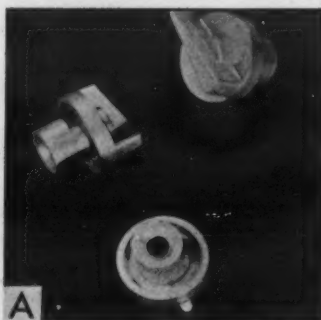
H & H is tops  
in tube design

P L A N N E D F O R P R E C I S I O N



## SCANNING PRESS RELEASES

♦ **FOUR EXAMPLES** of designing for automatic die casting are: (A) switch pointer; (B) automotive rear-vision mirror swivel; (C) brush assembly for IBM impulse counter; (D) setting gears and shafts for GE timers.



\* **VALUE ANALYSIS** information will be the theme of the Gries Reproducer Corp.'s Booth 1143 at the 1961 Design Engineering Show.

To help design engineers take advantage of small parts design improvements and cost reductions available through the use of high-speed, automatic die-casting and plastic-molding techniques, the GRC booth will feature displays illustrating the latest examples of improved small parts designs.

Several typical results of this low-cost design philosophy will be featured in detail. One will be a switch pointer used on a battery-operated toy manufactured by Emenee Industries. The pointer would have been produced normally by heading, but a "blind" hole in the pointer necessitated a costly secondary operation. Design engineers selected GRC automatic die casting and unit cost was cut 50 percent by incorporating the "blind" hole in the die casting.

In addition to custom die casting and plastic molding, Gries offers design engineers standard parts such as industrial fasteners, gears and pinions and coil bobbins that can be adapted for unusual or special needs.

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Circle 207 on Reader-Service Card for more information

# Robertshaw



## Control Components

### Exemplary products for original equipment

Robertshaw bellows, "packaged" bellows and other control components solve many design engineering problems in harnessing temperature, pressure and movement. These assemblies are custom-designed. Whether the need is for a few dozen or many thousands, Robertshaw gives personal service and on-time deliveries.

**BRIDGEPORT THERMOSTAT DIVISION**  
Robertshaw-Fulton Controls Company • Milford, Connecticut.



## Temperature Sensors

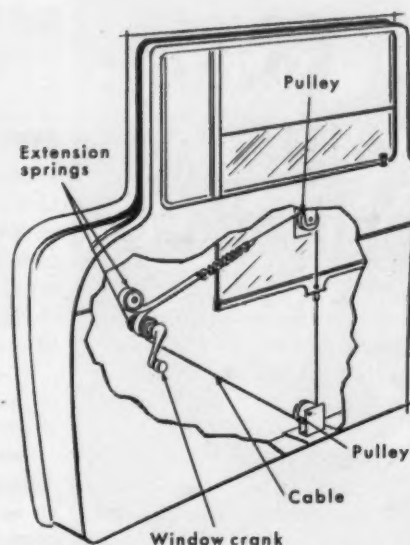
### Accurate, no-drift control for appliances

Robertshaw low-cost "packaged" bellows and Diastat® short-stroke assemblies for heat and cold control of refrigerators, ranges, skillets and other large and small appliances are completely assembled... custom-designed for fast, money-saving installation... are consistently calibrated... don't need resetting... don't need compensating devices for most applications... and give service that wins user recommendations for the appliance maker. Ask for Bulletins BT 436 and 60.

**\* AUTOMOTIVE APPLICATIONS** of the constant-force extension spring and constant-torque spring motor will be featured in Booth 863 at the 1961 Design Engineering Show by Hunter Spring Co., adjoining displays of other divisions of American Machine and Metals, Inc.

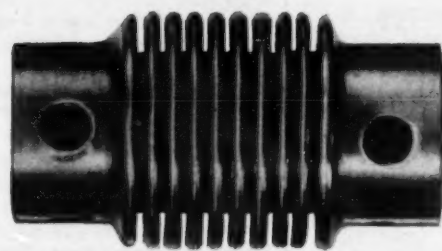
A typical auto window-lift mechanism design is shown in the sketch. Here two constant-force extension springs, mounted back to back, not only counterbalance the weight of the window to hold it in place at any position, but also simplify the mechanism linkage. The coil of one spring is mounted on the window crankshaft. Thus, it converts rotary crank motion into linear motion needed to operate the window, eliminating costly gearing.

**BACK-TO-BACK** springs counterbalance weight of automobile window. When crank is turned, window is raised or lowered almost effortlessly without gearing. Friction resisting upward motion increases tension in constant-torque springs requiring equivalent effort to be applied to crank. Similarly, friction resisting downward motion develops tension in cable which is transmitted to crank.



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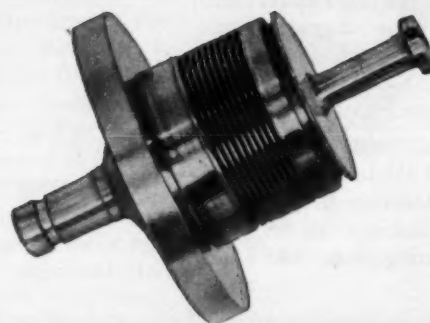
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## Flexible Couplings

**Eliminate backlash, end-play; absorb vibration and shock**

Servomechanisms, instruments and similar drive and control systems are the big users of these small units. Robertshaw flexible couplings are ideal for guarding against misalignment, friction and bearing wear problems. Save space and weight. Simplified design utilizes seamless metallic bellows, in choice of several metals, connected to two hubs. Stock sizes accommodate shafts from  $\frac{1}{8}$ " to  $\frac{1}{2}$ ". Other sizes custom-engineered. Write for Bulletin 80.



## Formweld® Bellows (WELDED)

**For applications requiring premium performance!**

Welded of any suitable alloy, Robertshaw FORMWELD Bellows give you the exact properties and characteristics you require. Resistance to temperatures above 1000°F., pressures to 3000 psi plus. Far greater flexibility per unit of length, lower hysteresis, greater load capacity without deformation and lower spring rates are available when you specify FORMWELD Bellows. Bellows sizes from  $\frac{1}{2}$ " O.D. to several inches. Sold only in complete "package" units. Bulletin BT 436.

**\* DESIGN ENGINEERS** will see technological advances in the metals industry from Haynes Stellite Co., Div. of Union Carbide Corp., in Booth 643 at the Design Engineering Show this year.

Blades and wheels made by this process will be displayed. A "Lycoming T53" gas-turbine engine full-scale cutaway will be shown to point out uses of alloys for high-temperature service in both wrought and cast form.

To point up another development, several interesting parts have been chemically etched to show results of a process whereby grain size is controlled to customer specification in different areas of a casting. Also on display will be diffusion parts, where a new process has been used to impart an oxidation-resistant coating to a high-strength part.

Rocket nozzles and other shapes made by hot pressing pure tungsten will be included in the exhibit. Boats and crucibles made of silicon nitride have recently been made for refining and crystal growing of transistor-grade germanium.

Another feature of the exhibit will be a selection of machinery parts made of alloys that are extending equipment life in many applications. Wear and corrosion resistance can be built into the machine with the specification of one of these high-grade metal parts.



# ACME Large Pitch Chain is "ENDURANCE TESTED" for Heavy Duty Applications

Here's a chain capable of withstanding the severest of abuse and punishing shock loads. Their glass-hard wearing surfaces and rugged heat treated links give you dependable performance under conditions far too grueling for ordinary chains.



In Acme's modern plant, these roller chains are pre-tested for strength and endurance. This is your assurance of efficient performance and durability under unusually severe requirements.

If you have a heavy-duty installation there's an Acme roller chain built with the characteristics necessary to do the job effectively and more economically.

Call your Local Industrial Distributor or our Engineering Department for fast service on your chaining problems.



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Write Dept. 14-Y  
for new ill. 100 page cata-  
log with engineering section.



RELIABLE CHAIN DRIVES FOR ALL INDUSTRIES

ROLLER CHAINS, SPROCKETS, CONVEYOR CHAINS, FLEXIBLE COUPLINGS, ATTACHMENTS. (Special and Standard)

## RELEASES



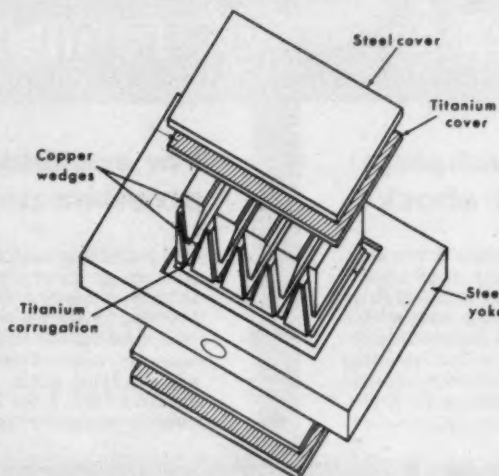
• **CORRUGATED-CORE SANDWICH PANELS** that reduce costs substantially have been developed in research sponsored by Douglas Aircraft Co. at Battelle Memorial Institute. The method requires no jiggling, provides completely sound core-to-cover bonds and allows panels to be extensively formed after assembly.

The process—called roll-welding—uses hot rolling to pressure-weld peaks of corrugated metal core to cover sheets.

Size of sandwich panels is limited only by rolling-mill capacity. One-fourth-inch-thick panels as large as 36 by 72 inches already have been produced. Roll-welded sandwich panels have been made of 2014 aluminum alloy, B-120 VCA titanium, unalloyed A-55 titanium, steel, molybdenum and "Inconel".

To form corrugated core, an accordion-pleated sheet of metal is woven over and under V-shaped inserts of a chemically soluble, deformation-resistant metal such as copper or iron. A rectangular metal frame is placed around core and face sheets of sandwich are added. Entire assembly is clamped in place by two additional metal cover sheets, which are welded to rectangular frame. Entire package is then hot rolled in a direction parallel to corrugations.

Roll-welding also can be used to produce sandwiches with vertically ribbed cores, since core design is determined by design of filler wedges. The only limitation is that core has to be unidirectional.



## HASTINGS DIFFERENTIAL PRESSURE INDICATOR

(An Electrical dp Gauge  
for Air and Gases)



CHOICE of **10** RANGES

.01" H<sub>2</sub>O through 100" H<sub>2</sub>O Full Scale

The Hastings Differential Pressure Indicator is composed of an indicator with power source unit and a dp tube. The indicator unit is available as shown or panel mounted, water proof and explosion proof housed and as control, alarm and recorder installations. The meter can be remotely located if desired.

The dp tube incorporates the patented Hastings compensated heated thermopile element which measures differential pressure directly in inches of water.

The Hastings Differential Pressure Indicator offers the following superior features:

- Extremely sensitive to low pressure differentials
- Rapid Response Time—less than 1/2 second
- Suitable for corrosive gases—Noble metal thermopile and nickel plated dp tube
- Versatile—Indicate, control, record—Remote
- Electrical rather than mechanical
- Readability from .0001" H<sub>2</sub>O thru 100" H<sub>2</sub>O
- Inexpensive—Less than most transmitter-type gauges
- Variety of Applications—Draft Gauge—Pressurized Enclosures—Mass Flowmeter—Process Control—Air Gauging—Leak Testing—Porosity Testing—Null Balance

Write or call for detailed specifications or for information on Hastings complete line of Vacuum, Pressure, and Flow Measuring Instruments.

**HASTINGS-RAYDIST, Inc.**

Hampton, Virginia PArk 3-6531

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COMPONENTRY BY

**CARDAIR**

**PRESSURES**

**TO 16,000 PSI**



° **STEEL LINE AND FITTINGS**

$\frac{3}{8}$ " Diameter Flow Passage

Leak-proof Fitting Seal

Balanced Line Valves

Low Torque at 12,000 PSI

Replaceable Seats and Spindles

Control Valves

Pilot Operated Valves

Pressure Vessels

° **DEHYDRATION EQUIPMENT**

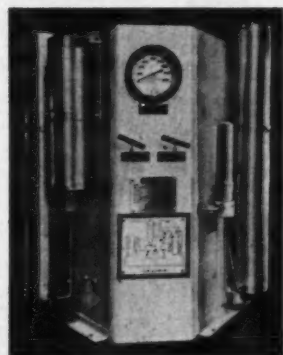
Cartridge Type Systems

Refrigerated Mechanical

Separators

Oil Vapor Removal to 0.3 PPM

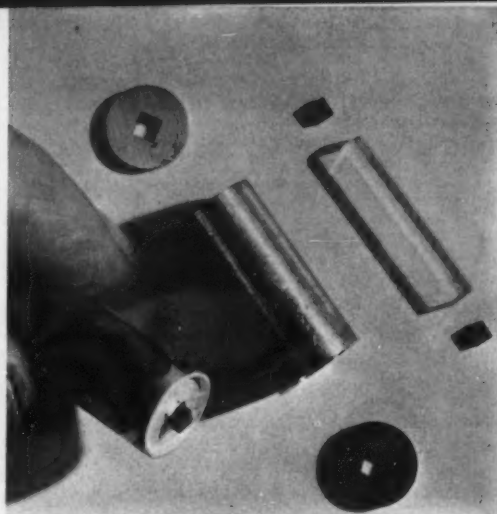
Minus 115°F. Dew Points



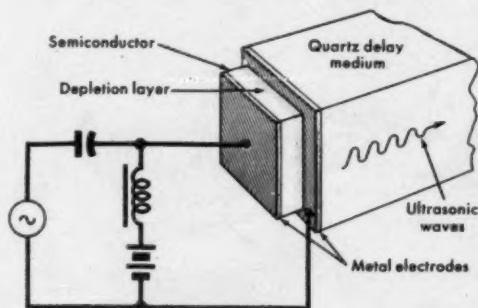
° **Write for Catalog Today!**

**PRESSURE COMPONENTS, Inc.**  
3429-D OCEAN VIEW BLVD.  
GLENDALE 8, CALIFORNIA

Circle 212 on Reader-Service Card



• **HIGH-FREQUENCY TRANSDUCER**, an efficient device for converting electrical energy into ultrasonic energy and vice versa at microwave frequencies, is a piezoelectric transducer utilizing a semiconductor depletion layer. It is expected to be employed primarily in ultrasonic delay lines, where its operation at high frequencies and wide bandwidths will make it possible to store large amounts of information.



The transducer consists of a plate of piezoelectric semiconductor (such as gallium arsenide) on which a thin metal film is deposited. The film constitutes a nonohmic rectifying contact which causes a depletion layer to form. (A depletion layer is a thin region of high resistivity that forms at the interface of two dissimilar materials such as a p-n junction in a semiconductor or a rectifying metal-to-semiconductor contact.) Thickness of the depletion layer can be controlled with a negative bias voltage across the interface.

When an a-c voltage is applied, most of the voltage drop occurs across the layer and the layer behaves in a manner similar to a very thin piezoelectric crystal which is bonded to a solid.

In experiments at Bell Laboratories, the depletion layer transducers operated well at frequencies as high as 830 mc. It is expected that improvements in circuit and fabrication techniques will greatly extend the frequency range.



Angular drives clustered in minimum space on stretch reducing mill operate at 8" 10 min. plus or minus.

## ANGULAR DRIVE DESIGN

*Now Made Easy with*



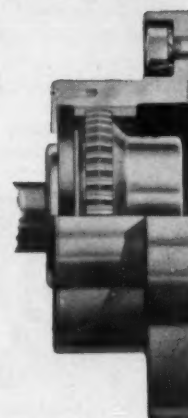
## Dihedral Couplings

When your design requires angular drives, the ability of Ajax Dihedral Couplings to permit angular and offset shaft alignment may offer a welcome answer.

The patented tooth design of Ajax Dihedral Couplings now makes possible smooth running angular drives in minimum space.

Double engagement and floating shaft types provide a wide range of adaptability to design requirements. Performance has been proved and approved in thousands of installations involving high torque, adjustability, weaving structures and other difficult conditions.

Feel free to draw on the broad experience of Ajax engineers and sales representatives to aid in working out your problems. Refer to the Yellow Pages under "Couplings" or phone or write...



Cut-away view shows typical arrangement of Ajax Dihedral gears specially designed for handling angular and offset shafts.

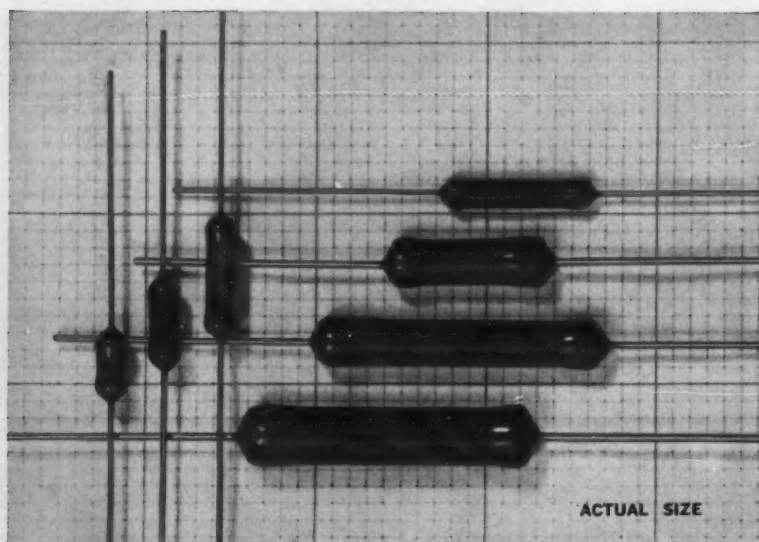
## AJAX FLEXIBLE COUPLING CO. INC.

28 Portage Road, Westfield, N. Y.

In Canada—The Alexander Fleck, Ltd., Ottawa

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## THESE "WIRE-WOUNDS" ARE CIRCUIT SHRINKERS.....

*newly expanded line lets AXIOHM® power resistors go into smaller circuits!*

Ward Leonard AXIOHM power resistors are now available in *seven* sizes—down to 2 watts, up to 12.5.

They're ideal for miniaturization in printed-circuits, industrial instrumentation and automation circuitry. But they're recommended for *any* electrical or electronic application where the highest stability and maximum overload capacity are required.

The seven AXIOHM sizes come in a

complete range of resistance values (see table) from 0.1 to as high as 75,000 ohms. Naturally, they feature the qualities Ward Leonard has made famous in power resistors:

Vitrohm vitreous enamel; Ward Leonard's specially made ceramic core; specially selected and matched resistance wire; and strong, permanent, low-resistance, spot-welded, lead-to-end-cap junctions.

0.9

SIZES AND RATINGS						
Rating (in watts)	Type	Resistances (ohms)		Dimensions (inches)		
		Min.	Max.	Length*	Diam.	
2	2X	0.1	5,000	3/8	3/16	
3	3X	0.1	10,000	1/2	3/16	
4	4X	0.1	15,000	5/8	3/16	
5	5XM	0.1	20,000	1 1/8	3/16	
7	7X	0.1	25,000	1	3/8	
10	10XM	0.1	50,000	1 3/4	3/8	
12.5	12.5X	0.1	75,000	1 3/4	3/8	

\*Less leads.

Get complete details in Supplement C to Catalog 15. Write for your copy and a list of stocking distributors today. Ward Leonard Electric Co., 26 South Street, Mount Vernon, New York. (In Canada: Ward Leonard of Canada, Ltd., Toronto.)



RESULT-ENGINEERED CONTROLS SINCE 1892

**WARD LEONARD  
ELECTRIC CO.** MOUNT VERNON  
NEW YORK

RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

Circle 214 on Reader-Service Card for more information

## RELEASES

• **HIGHLY MOBILE TELETYPEWRITERS** provide trouble-free operation under the most adverse environmental and technical conditions.

Designed to be extremely compact and light in weight, the MITE proved ideally suited to the "helicopter concept" of the modern Marine Corps. The entire send-receive teleprinter, including power supply, cables and a shock- and immersion-proof carrying case, weighs approximately 32 lb. The unit maintains reliable radio relay or wire circuit message sending and receiving in temperatures ranging from -65 to 131F, while withstanding severe shock and vibration as well as dust or salt-spray atmosphere.



The militarized version operates at speeds to 100 words a minute and speed changes can be effected by operator in less than a minute by a simple gear substitution.

The MITE is characterized by modular building-block construction to the extent that the transmitting keyboard is completely removable from unit and is capable of remote operation as a self-contained transmitter. All power supplies are plug-in units and the teletypewriter can be converted from 60 to 400 cycles or to d-c operation.

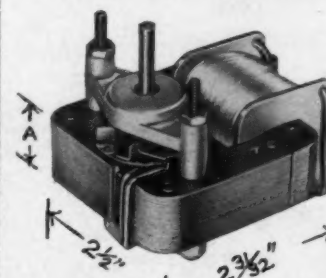
Mite Corp. of New Haven, Conn., is now building for the Marine Corps prototypes of companion equipment to perforate and read punched tape.

## GENERAL INDUSTRIES

# SMOOTH POWER

## AC MOTORS

offer unmatched quality  
and dependability yet  
cost no more—often less!



MODEL "A" two pole, shaded pole motor available in various lamination thicknesses. Precision constructed for reliable, long hard usage. Perfectly balanced for smooth quiet operation.

MODEL	HP 2800 RPM	Locked Torque in./oz.	Max. Torque in./oz.	Free Speed RPM	A
A-3-CW A-3-CCW	1/450	0.7	1.1	3360	3/8"
A-5-CW A-5-CCW	1/170	1.8	2.3	3430	3/8"
A-6-CW A-6-CCW	1/130	2.2	2.9	3470	3/8"
A-7-CW A-7-CCW	1/100	2.5	3.4	3480	7/8"
A-8-CW A-8-CCW	1/80	3.2	4.5	3480	1"
A-9-CW A-9-CCW	1/70	3.7	5.3	3480	1 1/8"
A-12-CW A-12-CCW	1/60	4.5	6.5	3500	1 1/2"
A-14-CW A-14-CCW	1/50	5.0	7.0	3490	1 3/4"

Standard shaft diameter .1817, 1/4" shaft available if desired.

Standard Line  
From  
1/1800 to 1/35 H.P.

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**SWEETS**  
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**S**  
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Quantity Price Quotation  
On Request

**THE GENERAL INDUSTRIES CO.**

DEPARTMENT GN • ELYRIA, OHIO  
Circle 215 on Reader-Service Card

• **SHATTERPROOF LIGHT BULB** has been made possible through the use of silicone adhesives and glass yarns.

Tradenamed "Fluorescent", this bulb can be dropped onto a hard surface without exploding into a shower of glass. While in use (and hot) it can be dipped in ice water without danger of flying glass fragments.



Application of new and old materials gives this lamp safety-glass ruggedness. The bulb consists of a glass shape wound with fiber glass yarn. Glass and yarn are bonded into a single unit with a rubbery Dow Corning silicone adhesive. While the bulb derives its name from the warm, flame-like glow it casts, its lumen output is actually higher than that of other processed bulbs. It is a glareless bulb and lasts at least three times longer than conventional lamps.

The new incandescent lamp is developed and marketed by Duro-Test Corp., North Bergen, N. J.



Circle 216 on Reader-Service Card

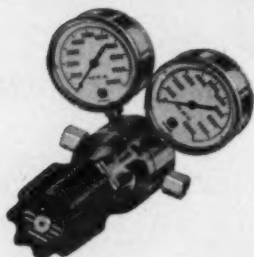


## VICTOR "CLEAN" REGULATORS

*Control gases safely and accurately to 10,000 psig.*

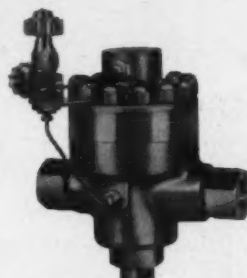
Victor high pressure gas regulators are cleaned, assembled, tested and packaged under carefully controlled conditions to insure maximum product reliability. Cleaning is performed to Victor standard or to customer specifications in a room approved by industry

and military agencies. Regulators shown here are typical of the available models covering a range of pressures to 10,000 psig. and capacities of 80,000 scfm. at  $-67^{\circ}$  F. to  $+250^{\circ}$  F. Write for Regulator Inquiry Form 361B and regulator bulletins.



GD700 SERIES  
GAS-O-DOME REGULATORS

Bronze or stainless steel  
Pilot operated—low torque  
Inlet to 10,000 psig.  
Outlet to 10,000 psig.  
Flows to 250 scfm.  
Panel Mounting



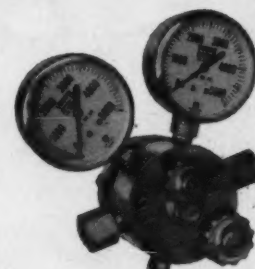
GD40, GD90, GD100, GD200 SERIES  
GAS-O-DOME REGULATORS

Bronze or stainless steel  
Remote or integral controlled  
Inlet to 6,000 psig.  
Outlet to 6,000 psig.  
Flows to 80,000 scfm.  
Panel mounting if desired.



LR SERIES LOADER REGULATORS  
BPR SERIES BACK PRESSURE  
REGULATORS

Bronze or stainless steel  
Inlet to 10,000 psig.  
Outlet to 10,000 psig.  
Flows to 10 scfm.  
Low operating torque:  
40 inch lbs. at 7,000 psig.  
60 inch lbs. at 10,000 psig.  
Panel mounting.



GD60 AND GD80 SERIES  
GAS-O-DOME REGULATORS

Bronze or stainless steel  
Remote or integral controlled  
Inlet to 10,000 psig.  
Outlet to 10,000 psig.  
Flows to 2,000 scfm.  
Panel mounting if desired.



**VICTOR EQUIPMENT COMPANY**

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1145 E. 76th St., Chicago 19

J. C. Menzies & Co., Wholly-Owned Subsidiary

Mfrs. of high pressure and large volume gas regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten castings; straight-line and shape cutting machines; roller and idler rebuilding machines.



Don't let these Devils INTERFERE



Troublesome maintenance and lubricating problems are eliminated when you specify Thomas "All-Metal" Flexible Couplings to protect your equipment and extend the life of your machines.

Like a thief in the night an inadequate coupling causes wear and damage to your machines—resulting in high maintenance costs and costly shut-downs.

UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:

- Freedom from Backlash
- Torsional Rigidity • Free End Float
- Smooth Continuous Drive with Constant Rotational Velocity
- Visual Inspection while in Operation
- Original Balance for Life
- Unaffected by High or Low Temperatures
- No Lubrication • No Wearing Parts
- No Maintenance

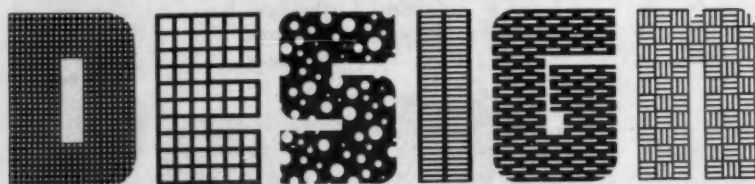


Write for Our New Engineering Catalog 60  
**THOMAS FLEXIBLE COUPLING COMPANY**  
WARREN, PENNSYLVANIA, U.S.A.

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**H&K** perforated materials

a perfect medium of



with functional or decorative uses

Harrington & King can perforate the proper design, pattern and open area in practically any metallic or non-metallic material available in coils, sheets or plates—from foil-thin to 1" thick. Specify H&K perforated materials on your next job.

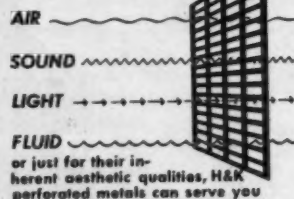
Write for General Catalog No. 75, Today!

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PERFORATING CO. INC.

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Wherever a product requires the passage or control of



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"Perforated Metals"

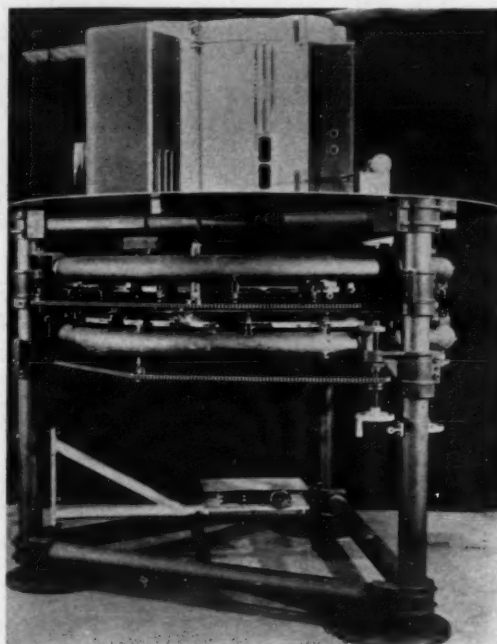
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## RELEASES

• "CLAM-SHELL" ARC-IMAGING FURNACE will grow rubies, sapphires and silicon-carbide crystals needed for advanced electronic devices.

The furnace utilizes two opposing concave mirrors to capture radiant energy from an electric arc and focus it into an area 1/2 inch in dia to create temperatures in excess of 3500K (6700F).

Shadowing losses are substantially reduced by locating the radiant energy source and specimen outside the reflecting system. Radiation enters the "clam-shell" reflecting chamber through a circular opening in the back of one of the mirrors and converges on a specimen outside an opening in the back of the second mirror.



In addition to crystal growing and materials research, the furnace could be used in refining, in chemical processing and in welding materials in any desirable atmosphere (or vacuum) free from contamination.

Primary advantage of imaging furnaces is that by optically concentrating radiant energy at a distance away from the burning arc, contamination of specimens is eliminated and better control over temperatures is provided for future industrial uses.

The furnace was developed by Air Force-Cambridge Research Laboratory, Bedford, Mass., and by Arthur D. Little, Inc., Cambridge, Mass.

**DESIGNING**  
new equipment?

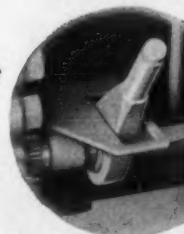
**IMPROVING**  
old equipment?

**SPECIFY**

**LOWELL**  
REVERSIBLE RATCHET  
**WRENCHES**

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functional  
accessories



- modification of a standard wrench...
- a special or unusual wrench...
- an entirely new design for your job...

Lowell design/engineering service is anxious to help with all types of problems involving turning adjustments on new or old equipment.

Modification of a standard ratchet wrench may provide a simple, inexpensive solution.

Or one of the many specials we have developed for unusual applications might well be the answer. It could be a bent, hinged or detachable handle; a long or odd-shaped socket; remote reversing control; special materials or finishes.

And if the problem requires an entirely new wrench or related ratchet device, we welcome the chance to help. Save yourself time... and rely on our wide experience with designers for the most economical solution.

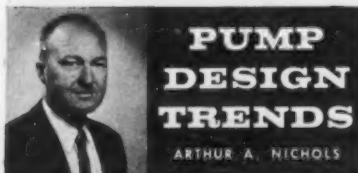
Send us your special problem now, or write for further information.

**LOWELL**  
**WRENCH CO.**

91 Temple Street  
Worcester 4, Mass.



Circle 219 on Reader-Service Card



## PUMP DESIGN TRENDS

ARTHUR A. NICHOLS

### NOVEL PUMP DESIGN ADAPTS TO MANY CONFIGURATIONS

► The reliability-proved Gerotor pump has long been recognized as a space-saving unit because of its extreme flexibility of design. That's because Gerotor pump capacity is a function of diameter, thickness, number of teeth and rpm of the two moving parts. These variables can be matched to just about any space restriction and capacity requirement. Now, you can save even more space by building three simple pump components integrally into your mechanisms with no more trouble than providing for an anti-friction bearing.



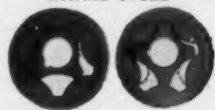
Fig. 1. Three Gerotor components permit pump to be incorporated as integral part of housing or frame of mechanism, eliminate need for purchase and mounting of separate, complete pump.

► A wide variety of sizes is available covering capacities up to 100 gpm and 1,000 psi. Unlike complete pumps, the inserts are extremely flexible in adapting to various mechanism geometries.



INTAKE CYCLE

► The resulting pump is a self-priming, positive-displacement, lightweight, valveless mechanism. It is long-wearing, and handles impurities in the fluid well. It can be made to pump in the same direction regardless of direction of rotation. It provides a relatively pulseless flow; volumetric and mechanical efficiencies are high; it is balanced and quiet in operation.



DISCHARGE CYCLE

► A unique combination of adaptability and reliability also accounts for the growing popularity of integrally designed pumps built with these Nichols packaged components. A wide range of applications includes circulating or lubricating systems, scavenging oil away from pumps, powering low-pressure hydraulic systems, replenishing other pumps, hydraulic brakes, etc.

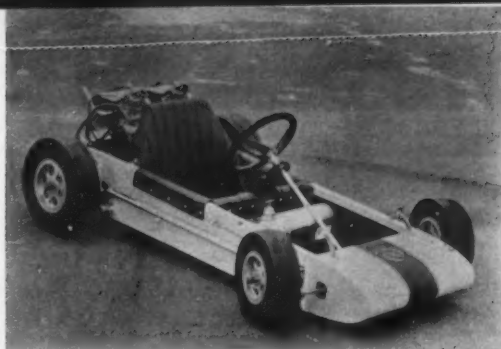
► Technical data is available. Write:

**W. H. NICHOLS CO.**

Makers of Zenith Metering Pumps  
and the Nichols Milling Machine  
"the miller that uses its head".

48 WOERD AVE., WALTHAM 54, MASS.

Circle 220 on Reader-Service Card



• **CLASSY GO-KART**, taking its style from the design of a Class B modified competition sports car, has a greater performance range than conventional carts, according to the design team which maintains it has eliminated the "bed spring" aspect inherent in many early models.

The compact "Excabur, Jr.", with its extremely low center of gravity, is constructed of riveted sheet aluminum, a contrast to the conventional tubing generally used. The unit has dual, self-energizing, external brakes; a center-pivoted, front-swinging axle, and an upholstered deep-dish bucket seat for the driver.

Powered by twin McCulloch MAC-10 engines, the 80-lb vehicle has already exceeded 100 mph in speed trials. Forty-six weight distribution gives the unit a decided advantage over conventional carts. The engines are mounted directly on the axle to avoid misalignment and the entire driving line is insulated from the body to avoid vibrations.

Industrial designer Brooks Stevens executed the design of the auto in a joint venture with his sons, David and William, both of whom operate the David B. Stevens Research and Development Center, Milwaukee, Wis.

• **ATMOSPHERIC IONS**—tiny particles and gas molecules with positive or negative electrical charges—may significantly affect human behavior in space vehicles, nuclear submarines or even in everyday situations.

Although the physiological and behavioral effects of air ions have been demonstrated experimentally since 1931, the advent of the nuclear submarine and the approach of manned space flight have put new emphasis on understanding effects of these charged particles.

The astronaut and submariner may be exposed to ion concentrations considerably higher than normal, and the effects of this increased ion concentration may be enhanced by other environmental factors such as acceleration stress.

According to Battelle Memorial Institute scientists, theories as to how air ions affect the human body involve electrical, chemical or hormonal mechanisms—either separately or in combination.

one  
stands out!



### AERO-SEAL JET® WORM DRIVE HOSE CLAMP

Designers know that sometimes even a relatively simple device is almost impossible to imitate, and AERO-SEAL has proved this point in the hose clamp field. The patented AERO-SEAL JET, for example, provides all of the advantages—including the security—of a precision worm drive clamp, yet permits almost instantaneous installation or removal. And AERO-SEAL bands and housings are of 302-18-8 stainless steel. All stainless also available.

AERO-SEAL solves countless fastening problems in electrical appliances, electronic, and chemical equipment. Complete range of sizes from 7/16" to 15 feet. Ask your industrial jobber.



**BREEZE CORPORATIONS, INC.**

700 Liberty Avenue, Union, N.J. • Cable Address: Breeze, Union, N.J.



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Switch to  
**Kulka**  
TOGGLE  
SWITCHES

Designed and built for long, rugged, dependable service, Kulka Toggle Switches provide positive, precise switching for electronic and electrical circuits. Made to Joint Army and Navy Specifications JAN-S-23, MIL-S-21195, MIL-S-6745 and MIL-S-3950A. Available in SPST, SPDT, DPST and DPDT types, DC and AC up to 1600 cps.

**NOW ... YOUR CHOICE OF TERMINALS**

SCREW —  
SOLDER —  
OR TAB

Now, specify the terminal type best suited to your needs. Standard screw terminal, hole-through solder type, or male tab for accepting Burndy, AMP or Kent female slip-on connectors.

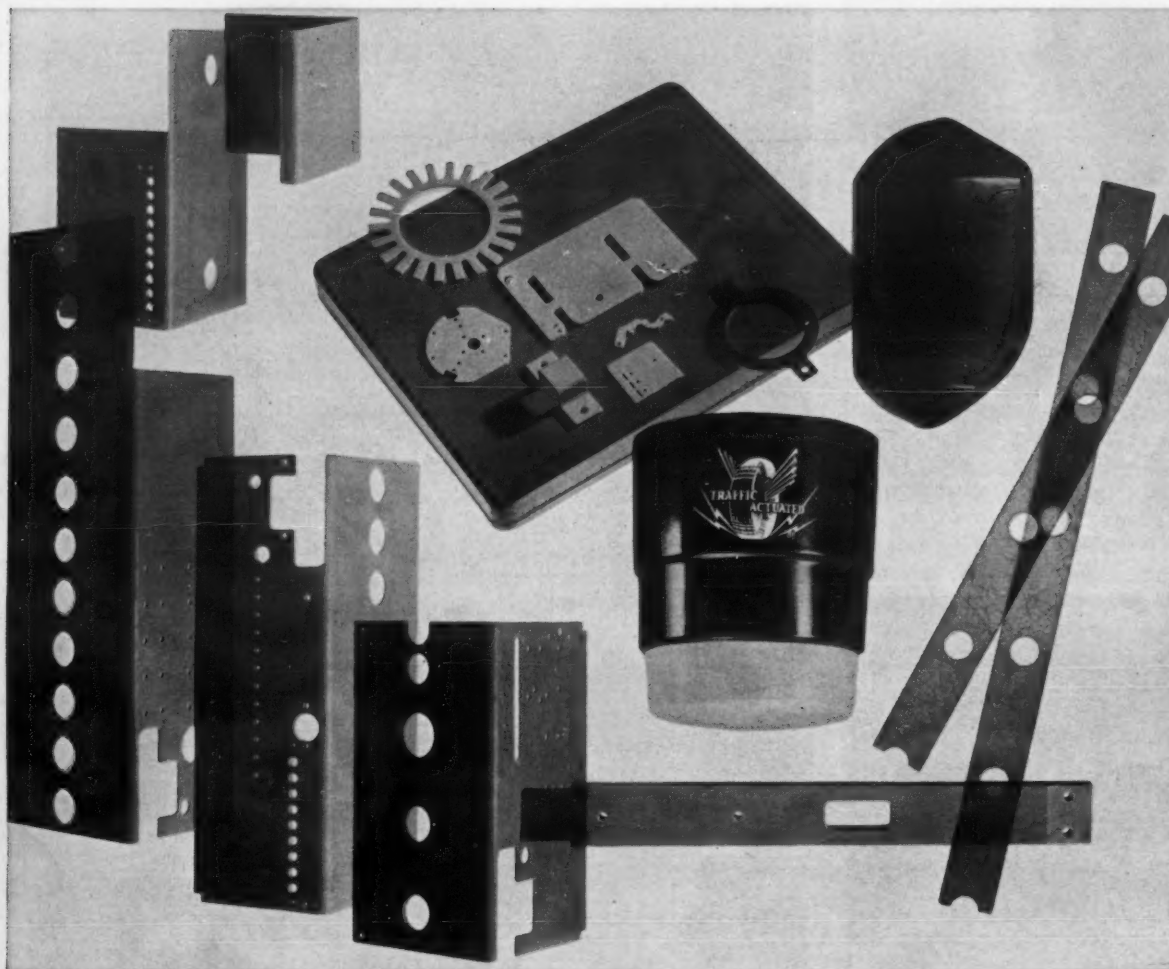
WRITE FOR COMPLETE DETAILS

**KULKA ELECTRIC CORP.**

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## Have you explored the full design potentials of molded polyester-glass?

Few materials offer the designer so many opportunities for product design simplification and cost reduction.

Added to the inherent toughness and strength of polyester-glass are good electrical and thermal properties, weather resistance—and flame retardance if you need it.

Using advanced molding and machining techniques, complex shapes and structures can be produced to reduce product weight or the number of parts, eliminate costly machining or stamping operations, simplify product assembly, improve product performance, life, or reliability.

These are the kinds of results our customers are achieving. For a few thought-starters—and facts about NVF polyester-glass products and molding services—contact your nearby NVF Sales

Office, or write for our new folder, Dept. LL-5, Wilmington, Delaware.

**116 Choices: One Source** This is the latest count of the different plastics and grades NVF can offer in your search for the *one best material*. Add to this total *the one special grade* that can be developed from scratch to meet your particular need. This full range of materials is backed by complete engineering services . . . from application assistance up to and including the delivery of 100% usable, precision-fabricated parts . . . in any quantity, on time!

Call the NVF Sales Office near you. It's a direct line to single-source help on your current materials problem.



**NATIONAL VULCANIZED FIBRE COMPANY**  
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## RELEASES

• **UNDERWATER ANTISUBMARINE MISSILES**, encased in an envelope of gas, may double projectile speed, according to the Convair Div. of General Dynamics Corp.

Much of the drag of a hydrodynamic body moving through water is caused by skin friction, water clinging to the surface of the body. By providing the body with a continuous gaseous envelope, it, in effect, moves through gas instead of through water. The water cannot cling to the skin.

The gaseous envelope, or vapor layer, has been created by heating the vehicle or by building into it a material which, in reaction with sea water, creates heat and vapor.

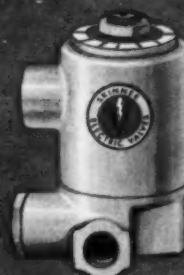
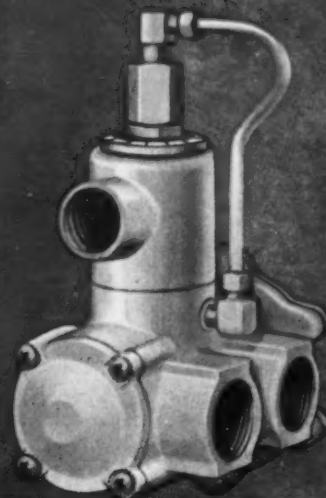
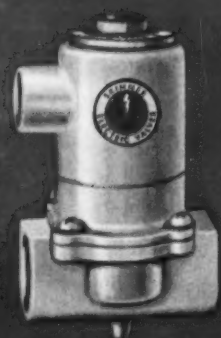


In experiments at Convair's towing basin, San Diego, Calif., a hydrodynamic graphite body 1 ft long and 1½ inches in dia was heated to 2000F and pulled through the water at speeds of 20 fps. Friction drag of the superheated body was reduced more than 90 percent below that of a cold graphite body.

The principle may be worthwhile for ballistic missiles fired from under the water, such as the Polaris. There would be some value in getting the ballistic missile from the submarine to the surface of the water faster and a great deal of value in permitting the missile to leave the ocean without dragging a lot of water with it.



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**SKINNER** EXPLOSION-PROOF  
SOLENOID VALVES



# Skinner has a complete range of Explosion-Proof Solenoid Valves

If you have a control problem involving valves operating in hazardous locations—Class I Group D (gasoline vapors, etc.), Class II Group F (coal and coke dust) and Group G (grain dust)—you can select from Skinner's complete line of two- and three-way explosion-proof standard and high pressure solenoid valves.

- U.L. approved
- A wide range of pressure ratings and orifice sizes
- Bodies and coil housings machined to close tolerances—clearance is 0.0005
- Stainless steel or naval brass bodies
- Stainless steel internal parts
- Stainless steel and brass internal parts

## STAINLESS STEEL TWO- AND THREE-WAY SOLENOID VALVES—X5 SERIES

The highest quality and most versatile valves manufactured. So flexible that basic valve can be modified to provide porting, mounting, or flow-control, to meet most applications.



Two-way solenoid valves are available normally closed, normally open and dual purpose. Orifice sizes from  $\frac{1}{16}$ " to  $\frac{3}{8}$ ", maximum operating pressure differential 3000 PSI depending on orifice size—NPT pipe size  $\frac{1}{8}$ ",  $\frac{1}{4}$ " and  $\frac{3}{8}$ ".

Three-way available normally closed, normally open, directional control and multi-purpose. Orifice sizes from  $\frac{3}{16}$ " to  $\frac{1}{2}$ ", maximum operating pressure differential 200 PSI depending on orifice size.

## TWO-WAY PISTON TYPE SOLENOID VALVES—XR SERIES

These valves, with forged naval brass body and stainless steel piston, handle high flow and high pressure requirements of industrial and commercial applications with most common media.



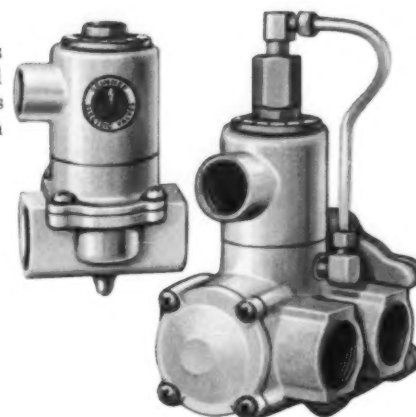
XR series valves are available with  $\frac{1}{4}$ " orifice and  $\frac{1}{4}$ " NPTF in normally closed or normally open construction. Operating pressure differential 5 to 1250 PSI for AC operation and 5 to 1000 PSI for DC operation.

## TWO- AND THREE-WAY HIGH FLOW SOLENOID VALVES—XL SERIES

These diaphragm type solenoid valves meet the high flow requirements of a great many commercial and industrial applications. The unique Skinner diaphragm construction makes possible the exceptionally long service life of this series valves.

Two-way XL series valves are available normally closed and normally open. Orifice sizes are  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1" with corresponding NPTF pipe connections. The  $\frac{1}{2}$ " orifice model is also available with  $\frac{3}{8}$ " NPTF. Operating pressure differential is 5 to 150 PSI.

Three-way XL series valves are available normally closed, normally open and directional control. Orifice sizes are  $\frac{3}{8}$ ",  $\frac{1}{2}$ " and  $\frac{3}{4}$ " with corresponding



NPTF pipe connections. Operating pressure differential is 5 to 150 PSI for the  $\frac{1}{2}$ " and  $\frac{3}{4}$ " size and 10 to 150 PSI for the  $\frac{3}{8}$ " size.

## TWO- AND THREE-WAY HIGH PRESSURE HYDRAULIC SOLENOID VALVES—X10 SERIES

These stainless steel, direct acting, slide-type valves are precision engineered to control hydraulic systems at pressures up to 2000 PSI.

These high pressure hydraulic valves have a  $\frac{3}{8}$ " inlet and cylinder orifices with  $\frac{1}{4}$ " NPT. They can be used as two-way normally closed or two-way



normally open valves by plugging the appropriate port, and three-way normally closed, or three-way normally open, or dual purpose valves.

For complete information, contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

When you specify solenoid valves, specify Skinner. Skinner solenoid valves are distributed nationally.



THE CREST OF QUALITY

# SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIVISION  
SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.

• **COMMERCIAL THERMOELECTRIC REFRIGERATOR-FREEZER**, claimed to be the world's first, has been introduced by the Norge Div. of Borg-Warner Corp. Five hundred of the units will be installed in rooms of a new Sheraton-Chicago Hotel, scheduled for opening in Chicago in May. The thermoelectric unit has no mechanical compressor or refrigerant fluid.

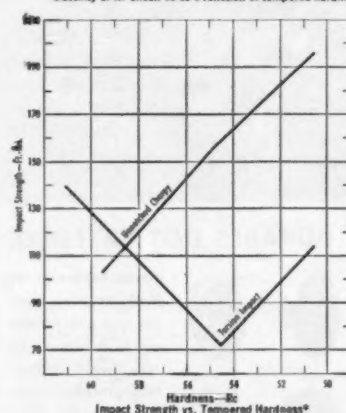
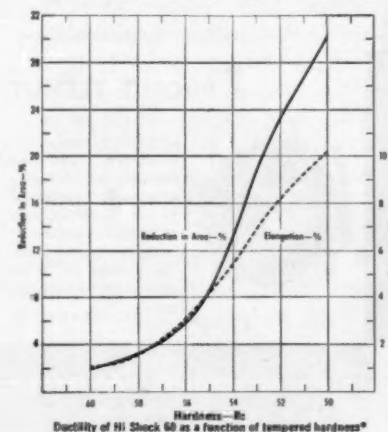
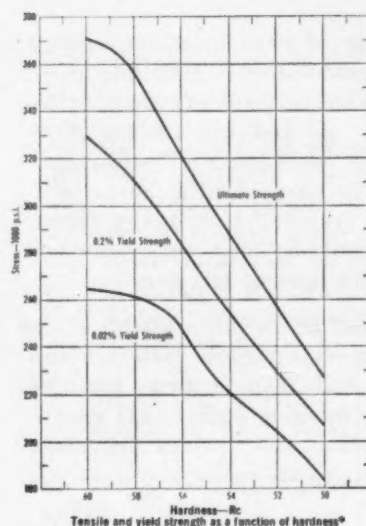
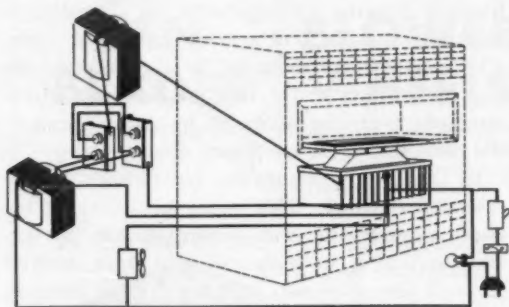
Thermoelectric cooling is a sensible temperature change occurring at the junction of two dissimilar metals when a direct current is passed through them. The amount of cooling taking place is proportional to the amount of current flowing.

In this case, the dissimilar metals are alloys composed of bismuth and tellurium plus smaller amounts of an impurity element, having in one case an excessive number of electrons, forming a negative element, and in the other case a scarcity of electrons, thus forming a positive element. For the cooling effect, a fixed direction of current flow will determine which end of the thermocouple will be the cooling side.

The refrigerating system consists of a primary a-c electric power supply and a secondary d-c rectifier unit. Current is transmitted from an ordinary 115v outlet through a three-amp protective fuse to an "On" and "Defrost" control switch.

A 10w air-circulating fan cools the hot junction fins, and a thermostatic safety cut-out switch protects the thermoelectric device from harm resulting from accidental overheating. The 115v current then passes through the primary side of the transformer and by induction creates a 5½v a-c flow through the secondary side of the system.

Heat pumping action of the thermocouples begins when a constant flow of low voltage direct current passes through them. The d-c is obtained by passing the low voltage a-c through a series of silicon rectifiers, and the uniform voltage is controlled by means of a filter choke. The heat contained within the insulated enclosure is literally pumped or transferred from that area through the thermocouples to the hot junction plate and radiating fins. From there it is dissipated into the surrounding atmosphere.



\*Austenitized 1600°F, 20 minutes at heat, air cooled. All tempers 1 hour at heat.

## Carpenter steel

you can do it consistently better with Carpenter Tool and Die Steels

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.  
Export Dept., Port Washington, N. Y.—"CARSTEELCO"

Alloy Tube Division, Union, N. J.

Webb Wire Division, New Brunswick, N. J.

Carpenter Steel of New England, Inc., Bridgeport, Conn.



Circle 225 on Reader-Service Card for more information

## NEW ultra high strength steel... for critically-stressed components

Carpenter HI SHOCK 60 is a new air-hardening steel for applications requiring extreme shock resistance. It can be heat treated to tensile strength in excess of 350,000 psi and retain substantial ductility and impact strength at that level. In addition to exceptional toughness, its benefits include good machinability and a low hardening temperature. As an ultra high strength steel, it is recommended for critically-stressed components where maximum

strength must be combined with least sacrifice of toughness.

These tables and graphs will help you to determine whether or not HI SHOCK 60's unique combination of properties provides a suitable solution for any of your current design problems. By using the coupon below you can get more detailed technical data as well as an actual sample of this new ultra high strength steel to test in your own plant.

### Mechanical properties:

#### Effect of tempering temperature on Tensile Properties

Austenitized 1600°F, 20 minutes at heat, air cooled, tempered as indicated, one hour at heat.

Tempering Temp.	0.02% Yield Strength	0.02% Yield Strength	Ultimate Strength	Elongation %	Reduction of Area %	R <sub>c</sub>
475°F	259,000	316,000	363,000	1.6	3.1	58
675	251,500	283,000	320,000	3.5	7.8	56
800	224,500	259,000	295,000	4.0	8.5	54
1000	204,500	229,000	251,000	8.2	23.5	52
1075	184,000	206,000	226,000	10.2	30.9	50

#### Effect of tempering temperature on Impact Properties

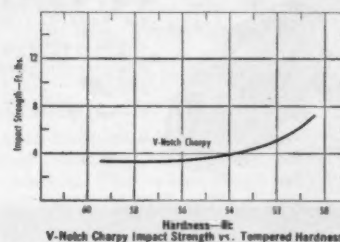
All specimens austenitized 20 minutes at 1600°F, air cooled, tempered as indicated, one hour at heat.

A. Unnotched Charpy			B. V-notch Charpy		
Tempering Temp.	Av. Ft.-lbs.	R <sub>c</sub>	Tempering Temp.	Av. Ft.-lbs.	R <sub>c</sub>
375°F	102	60	375°F	3.5	59.5
700	158	55	700	3.5	54.5
1050	191	50.5	1050	7.0	50.5

### Thermal expansion properties:

Temperature from 75°F to	Coefficient in/in/°F x 10 <sup>-6</sup>
122°F	4.76
212	5.12
302	6.41
392	6.87
482	7.21
572	7.38
662	7.33
752	7.03
842	6.52
932	6.46
1022	6.50
1112	6.66
1202	6.81
1292	6.89

Critical Temperature A<sub>c3</sub> = 1435°F.  
Austenitized 20 minutes at 1600°F, air cooled, tempered one hour at 350°F.



Use this coupon for more data...  
free sample

Attention: T. A. Washburn, Manager,  
Tool Steel Sales

The Carpenter Steel Company,  
Dept. 120, Reading, Pa.

☐ Send HI SHOCK 60  
Technical Data Sheet

☐ I'd like a sample of  
HI SHOCK 60 for testing

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_

Zone \_\_\_\_\_ State \_\_\_\_\_



# HOW MANY WAYS CAN Special Purpose Fasteners CUT COSTS FOR YOU?

How many of your products employ laborious, old-fashioned fastening methods where simple fasteners could do the job and cut costs, too? How many parts and sub-assemblies can be adapted to include a self-fastening feature? How many future products could be improved by advance planning for fastener efficiency?

United-Carr's engineering staff offers you a wealth of experience in the design of special-purpose fasteners and self-fastening devices. Large-scale manufacturing facilities (including in-plant plastics molding equipment) ensure economical, *volume* production and prompt deliveries. United-Carr field representatives are ready to call on you at *your* request.

The names DOT, TEENUTS, TRIMOUNT are registered trade-marks of United-Carr Fastener Corporation

## POLYETHYLENE MOUNTING FOOT



No mar, no scratch glide for use on TV receivers, record changers, small appliances, etc. Assembles into round hole in wood or metal cabinets.

## NYLON SNAP-IN NUT



Snap into square hole stamped out of sheet metal... provides secure anchorage for any sheet metal or self-tapping screw... highly effective electrical insulator.

## QUICKEY FASTENER



Eliminates need for welding or swaging studs to sheet metal stampings, facilitates nesting, eliminates damage in transit because Quickey snaps in before final assembly.

## 6-PRONG TEENUT



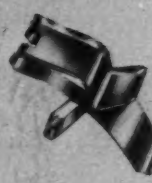
Offers greatly increased push-out resistance; virtually eliminates the problem of lost fasteners, cuts rejections, customer complaints, etc. Claw-like prongs toe in for maximum gripping power.

## PLUG BUTTONS



Snap into 1/8" to 3" dia. holes. Can be embossed with ornamental or functional designs... various finishes, shapes and sizes.

## WIRING FASTENER



Mounting legs snap into round hole... provide secure anchorage. Body of fastener holds wires without chafing.

## MOLDING FASTENER



Ideal for use with thread cutting fasteners or available with threaded stud for nut and lock washer assembly. Spring leg maintains tension to keep fastener blade locked in molding channels.

## TEENUT



One-piece, all-metal nut has welding bosses on upper or lower surface of mounting flange. Has high tensile strength and provides secure, permanent anchorage for bolt. Available in various shapes and sizes.

## TRIMOUNT STUDS



Hold two or more thicknesses of material together. Easily installed by hand. Insure vibration proof attachment. Permanent or removable. Many shapes and sizes.

## DURABLE DOT FASTENER



Snap fastener for cloth, leather, plastics and other materials. Positive closure, instant release. Black, nickel or brass finish.

## RELEASES

• **IONIZATION GAGES**, to sniff the thin atmospheres of near space and to measure their density, have been designed and built by the Westinghouse Electronic Tube Div. for the NASA's Goddard Space Flight Center. Tested in space Nov. 15, 1960, as part of the instrumentation for an Aerobee Hi Rocket, one of these gages provided direct measurements of pressures and densities prevailing at altitudes from 70 to 125 miles.

Because of their wide range of sensitivity—1 times  $10^{-3}$  to 1 times  $10^{-10}$  mm of mercury—the units are expected to be useful in gathering data at altitudes from 70 to 450 miles, where prevailing molecular densities range from 5 times  $10^{14}$



molecules per cu in to 5 times 7 molecules per cu in.

Gages are triodes whose elements are a tungsten filament drawing 1.5 amps at 4v, an ion collector working at -30v and a grid working at 150v. The elements are mounted in a glass envelope 3 1/2 inches long and 1 inch in dia, into which atmosphere can be admitted by "unstopping" the open end of the envelope.

In use, electrons from the hot cathode are accelerated across the 150v potential difference between cathode and grid, acquiring sufficient energy to ionize gas molecules that have entered through the open port into the area of electron bombardment.



Booth Number 1242  
Design Engineering Show

## CARR FASTENER COMPANY

Division of United-Carr Fastener Corporation, Cambridge 42, Mass.

Offices in: Atlanta, Boston, Chicago, Cleveland, Dallas, Detroit, Kalamazoo, Los Angeles, Louisville, New York, Philadelphia, San Francisco, Seattle, Syracuse

Circle 226 on Reader-Service Card for more information

PROBLEM:  
Torsion Fatigue in Rubber Hose

SOLUTION:

## CHIKSAN SWIVEL JOINTS

Chiksan Swivel Joints, with free turning 360° rotation allow hose lines to be flexed without the twist caused by fixed position fittings. With Chiksan Swivel Joints hose lines last longer, maintenance and downtime are virtually eliminated.

Send for Illustrated Catalog.



**CHIKSAN COMPANY**

BREA, CALIF.; CHICAGO 5, ILL.; NEWARK 2, N. J.

Circle 227 on Reader-Service Card for more information

• **EGGSHELL ARMOR PLATE** from 1/100 to 1/4 inch thick can be used so effectively to protect a spaceship from meteoroids that overall weight of ship's outer walls can be reduced more than 50 percent with no loss of safety, according to a General Electric space-vehicle structures engineer.

A test to determine strength of the shield involved blasting more than 300 metal pellets at speeds up to 13,000 mph into targets representing both shielded and unshielded space-vehicle "skin".

Shielding consisted of sheets of steel aluminum or magnesium bolted into a position from 1/4 to 1 inch away from a thick aluminum plate. The shielding was effective in dissipating part of the energy of the oncoming projectiles causing only a relatively mild pitting of the vehicle's skin.

At high velocities shielding caused projectile to shatter, further cutting down its destructive force.

Meteoroids—small hyper-velocity pieces of metal or stone in space—are one of the major dangers that must be protected against in spacecraft design. They can rip through vehicle walls, causing either damage to or destruction of the vehicle. In the tests, varying shield and material thickness, spacing between shield and structural wall, pellet velocity, and pellet size and material were investigated and analyzed. Pellets ranged in size from 1/8 inch dia by 1/8 inch long to 1/2 inch dia by 1/2 inch long and weight range was from 0.07 to 4.30g. Shield materials included aluminum, steel and magnesium. Pellet materials were aluminum, steel and titanium.

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MACHINING  
CAST BRONZE  
NYLON  
SINTERED BRONZE  
ALUMINUM

## bearings and parts

Take the simple, sure, direct route to lower manufacturing and maintenance cost. Design into your product Bunting Standard Stock Bearings. You avoid inventory investment, delays, confusions, production problems by the immediate availability in small or large lots, from local distributors all over America, of hundreds of different stock sizes of completely finished cast bronze and sintered bronze bearings and bars, aluminum bars and Nylon shapes.

Special design bearings not obtainable from stock can be procured immediately at low cost from Bunting fully equipped machine shops in five industrial centers. The wide range of sizes of Bunting Stock Cast Bronze and Sintered Bronze Bearings makes the alteration of a stock item to a special bearing easy and economical. Bunting Cast Bronze, Sintered Bronze, Aluminum Bars and Nylon shapes provide the materials for special requirements which cannot be made from stock bearings. Your local Bunting Distributor can arrange for such work.

A large staff of bearing engineers in the field stands ready to assist in the use of these Bunting stock products and in the designing of bearings or components for extraordinary applications. Two big, modern plants assure ample production capacity at all times for bearings and parts made from all modern metals and materials.

See Bunting's complete catalog, Sweets Product Design File 11C/BU or ask for Bunting's General Catalog, Form 158; Nylon Catalog, Form 32; Technical Handbook on Bunting Nylon, Form 33; The Technology of Bunting Aluminum, Form 46; Engineering Handbook of Powder Metallurgy, Form 1; Bunting Machine Shop Service, Form 4.

The BUNTING Brass and Bronze Company  
TOLEDO 1, OHIO  
BRANCHES IN PRINCIPAL CITIES



BEARINGS, RUSHINGS, BARS AND SPECIAL PARTS OF CAST BRONZE, SINTERED METALS, ALUMINUM ALLOYS AND NYLON

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### AIR IMPELLER BROCHURE FREE!

**Revcor**

**FAN BLADES**  
8 types for all applications. Diameters ranging from 6" through 48".

**BLOWER WHEELS**  
Single and double inlet. Diameters from 3-27/32" to 15". Widths 1" to 15". Housings and Inlet Rings available.

**Revcor INC.** 259 EDWARDS ST.  
CARPENTERSVILLE  
ILLINOIS

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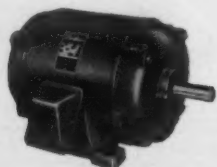
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# Special Motors are Standard

## AT PEERLESS ELECTRIC!

Need a special motor? Our knowledge may aid in reducing the engineering time. We are the exclusive supplier to many manufacturers for motors with unusual operating conditions and duty requirements. Write us your needs!



### DRIP-PROOF (open type)

Completely protected against dripping liquids and falling particles.

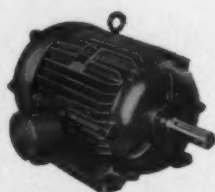


### DIRECT CURRENT

High starting torque, good overload capacity and high electrical efficiency. For rough usage.

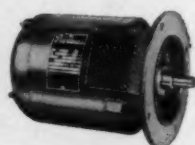


### EXPLOSION-PROOF TORQUE MOTOR WITH BRAKE

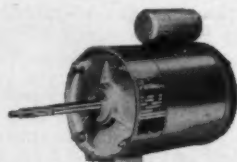


### TEPC and EXPLOSION-PROOF

External fan draws cool air across motor toward driven machine.



### WEATHER-TIGHT SPECIAL FLANGE



### SPECIAL FLANGE REVERSING HOIST MOTOR, SINGLE PHASE

**ENGINEERING DATA:** Special mountings. Various modifications—special shaft features; paint and varnish treatments, Class A, B, F, H insulation. Peerless builds to standards and specifications of JIC, AIEE (including AIEE No. 45 Marine Duty), ABS, Federal and Military.

**WRITE FOR BULLETINS:** Space-Saver, SP-1; Torque, T-1; Complete Line, SDA-155. Peerless Electric Division, H. K. Porter Company, Inc., W. Market Street, Warren, Ohio.

### PEERLESS ELECTRIC DIVISION



### H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Circle 230 on Reader-Service Card for more information

## RELEASES

• "UNSINKABLE" research vehicle, built to provide maximum "swimmability" with minimum weight, may score a significant first for the Army in the art of tactical vehicle design.

The XM-521 features a unitized bonded body constructed of thin "sandwiches" of aluminum honeycomb panels. Sixteen times stronger than an equal weight of steel and 10 times stronger than an equal weight of aluminum sheet, honeycomb construction provides unusual strength coupled with great weight reduction and buoyancy.

Capable of performing with equal flexibility on inland waters or rugged, cross-country terrain, the vehicle can be transported by cargo aircraft and dropped by parachute. It is compact, light, yet able to carry a 5000-lb payload (or 16 men with full equipment) while traveling at speeds up to 55 mph on roads and 5.2 mph in water.

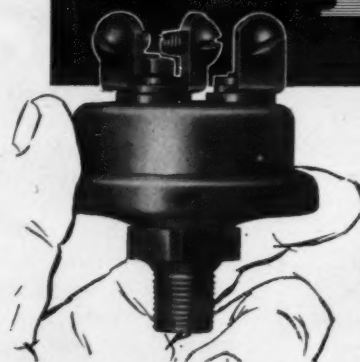
Buoyancy is provided by aluminum honeycomb panels which form airtight cells and by the utilization of polyurethane foam in wheel well sponsons.

The vehicle was designed by Detroit Arsenal under the direction of the U. S. Army Ordnance Tank-Automotive Command. The Evansville Defense Div. of Whirlpool Corp. fabricated the body from metal produced by Kaiser Aluminum.



## Hobbs **D**UAL CIRCUIT PRESSURE SWITCHES

Add a NEW  
**D**IMENSION  
to Pressure Activation!



### A COMPLETE LINE OF PRESSURE SWITCHES

Also available — a wide selection of single circuit pressure switches. Built by the manufacturers of Hobbs Running Time Meters and Shock-Mounted Head Lights. Distributors in principal cities . . .

Write for CATALOG PS605



**DOUBLE DUTY!** Disconnects one electrical circuit while placing the other in operation. Industry-approved for a wide range of applications in dual circuit activation of various types of instruments, warning signals, safety devices, fuel pumps — in many other ways for making and breaking circuits. Ideal for locking out a starting motor while the engine is running. Can be used with oil or air . . . or with standpipe, almost any liquid or gas.

- Non-ferrous pressure chamber
- Phosphor-bronze diaphragm
- Alloy contacts
- Preset at factory

Available in pound setting specifications in both circuits within ranges of 3-6, 7-14 and 15-60 psi. Compact — only 1-11/16" diameter. Pressure assembled and pre-tested at 150 psi. Designed for use on direct current.

### John W. Hobbs Corporation

A DIVISION OF STEWART-WARNER CORPORATION  
1049 YALE BLVD., SPRINGFIELD, ILLINOIS

Circle 231 on Reader-Service Card for more information

\* **FLYING SPARKS**, silent sound and "free" electrical power from waste heat will be three of the attractions at the Lead Industries Association exhibit, Booth No. 111, at the Design Engineering Show.

The flying sparks will come from a candy-bar-sized device called a "spark pump". Built around two small pellets of lead zirconate-titanate, this piezoelectric generator produces a 20,000v spark. Design specialists in gasoline engines will be interested to know that the device is already at work replacing the magneto, coil, points and condenser in small engines.

The same versatile piezoelectric-ceramic material can be used as well to change electric power to mechanical power. This will be shown with "silent" sound—waves of ultrasound pitched so high that the ear cannot detect them.

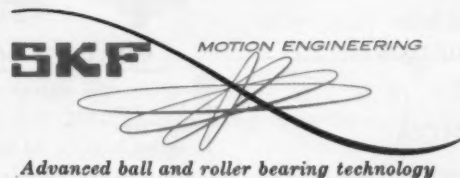
Another generator will convert heat to electric power directly, without any moving parts. This is a lead-telluride thermoelectric device which can be used to derive power from waste heat sources such as furnace flues and automobile exhaust manifolds.

Still another feature of the exhibit will be a bucket of noise—a lead enclosure containing a noise source to show lead's sound-stopping power.

Other lead products and recent developments include leaded ceramic finishes for glass, steel, magnesium and aluminum; lead nuclear shielding; data concerning lead's acoustical properties; samples of and data about lead anodes for corrosion protection; lead-acid storage batteries, and two novel dry bearings employing leaded "Teflon" and lead monomoxide ceramics.



## BEARING WITH A RED HOT FUTURE



Advanced ball and roller bearing technology

On special test equipment in SKF's research laboratory, experimental ball and roller bearings are run at temperatures up to 1000° F and above—conditions under which steel becomes red hot and loses its strength, while conventional lubricants burn or boil away. To meet these problems, bearings made of special heat-resisting alloys and exotic new materials are tested and evaluated. New ideas in design and new approaches to lubrication are constantly being investigated.

Bearings to resist extremely high temperatures are needed for improved, high performance jet engines, gas turbines and other equipment. Special SKF bearings have been tested successfully in environments at about 1000° F. Under certain conditions of operation, much higher temperatures are practical.

Research like this is your assurance that SKF will always keep pace with demands for the highest possible performance in all major types of rolling contact bearings—ball, cylindrical roller, spherical roller, tapered roller and precision miniature. SKF Industries Inc., Philadelphia 32, Pa.

6103



# ROPER PUMPS

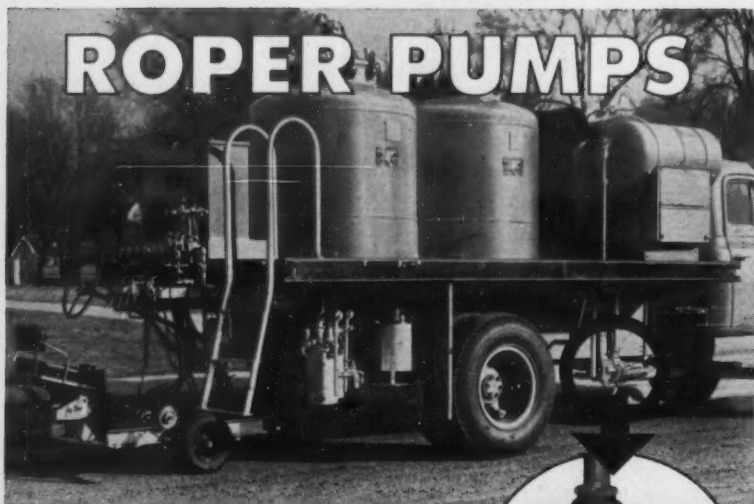


Photo courtesy of Kelly-Creswell Co., Xenia, Ohio

## transfer paint from drums to pressure tanks on highway marking machine

• CAPACITY: 40-300 GPM • PRESSURE: 100 PSI

Roper Series 3600 pumps have been a dependable part of Kelly-Creswell highway zone marking machines for many years. The Series 3600 HBZRV-2A model transfers paint mixture from drums to pressure tanks, delivering trouble-free, low-maintenance service, even when handling light-reflective paint containing highly abrasive granules. Roper tank truck pumps are compact, complete units, built with drive shafts on upper or lower gears, depending on type of mountings to be used. Built-in steam chests are available. Series 3600 pumps are specified by many manufacturers of original equipment for the petroleum, process, packaging, and chemical industries for dependable service in handling a wide variety of liquids—thick or thin—under all kinds of industrial conditions.

### GEARED TO THE ROUGHEST USE

- ▶ **TWO** equal sized, heat-hardened alloy helical gears are the only moving parts. Perfectly balanced construction, accurate machining, provide vibration-free service.
- ▶ **FOUR** heavy-duty, high-lead bronze or chrome-iron bearings, hardened for long service, support pumping gears.
- ▶ **PRECISION-GROUND** steel shafts are induction hardened at bearing and packing surfaces. Special shaft lengths are available to fit your equipment requirements.

For information about how Roper pumps can serve your equipment, contact your Roper dealer.  
Send for "How to Solve Pumping Problems" booklet

**ROPER**  
**HYDRAULICS, INC.**

Dependable pumps  
since 1857

COMMERCE, GEORGIA

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Series 3600

## RELEASES

\* **MONORAIL VEHICLE**, conceived to operate on the streets in the city of tomorrow and to be carried at high speeds on a unique monorail system, employs stainless steel in body panels, pillars and rocker panels to assure high strength-weight ratio and high corrosion resistance.

Nearly all systems proposed to date make use of multipassenger vehicles or "trains". Few, if any, have considered the monorail as a means of transporting personal vehicles from point to point so that the traveler may have private transportation at his destination.

As one solution to this problem of the future, the McLouth Steel Corp. of Detroit will unveil the XV'61 at the 1961 Design Engineering Show, Booth 810.

The display will feature a full-scale model of a four-passenger vehicle. Affixed to a platform or "pod" which is mounted on a section of the monorail track, the vehicle demonstrates how it could be carried safely at speeds exceeding 100 mph above traffic despite weather delays.



er delays.

Speed of the vehicle, distance between vehicles and departure from monorail at the destination point are controlled electronically. Upon arrival, car is released from pod, driver assumes control of the vehicle and pod is ready for the next traveler.

Although the vehicle is of radical design, the firm of William Schmidt Associates who designed the display say that in its present form it could be manufactured today and put into operation if their concept of the monorail were in existence.

## MARVEL Synclinal FILTERS

FOR DEPENDABLE PROTECTION on all HYDRAULIC and other low pressure circulating systems



### Synclinal Sump Type

**Capacities:**  
5—8—10—20—30—50—75 and 100 G.P.M.

**Pipe Sizes:**  
¾"—1"—1½"—1½"—2"—2½" and 3".

**Connections:**  
Coupling—Male Nipple.

**By-pass Valve:**  
Not Available.



### Synclinal Line Type

**Capacities:**  
5—8—10—20—30—50—75 and 100 G.P.M.

**Pipe Sizes:**  
¾"—1"—1½"—1½"—2"—2½" and 3".

**By-pass Valve:**  
Not available.

**Operating Pressures:**  
Up to 80 p.s.i.



### Bonded Line Type

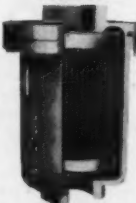
**Capacities:**  
10—20—30—50 and 75 G.P.M.

**Pipe Sizes:**  
1"—1½"—1½"—2" and 2½".

**By-pass Valve:**  
Available with or without.

**Operating Pressure:**  
Up to 250 p.s.i.

**Operating Temperature:**  
Up to 300° F.



### In-Line Filter

**Capacities:**  
Up to 60 G.P.M.

**Pipe Sizes:**  
¾"—1"—1½"—1½"—1½" (at both inlet and outlet).

**By-pass Valve:**  
Available with or without.

**MARVEL ENGINEERING COMPANY**  
7227 N. Hamlin Ave., Chicago 45, Ill.  
PHONE: Juniper 8-6023

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Name \_\_\_\_\_ DN-5  
Company \_\_\_\_\_  
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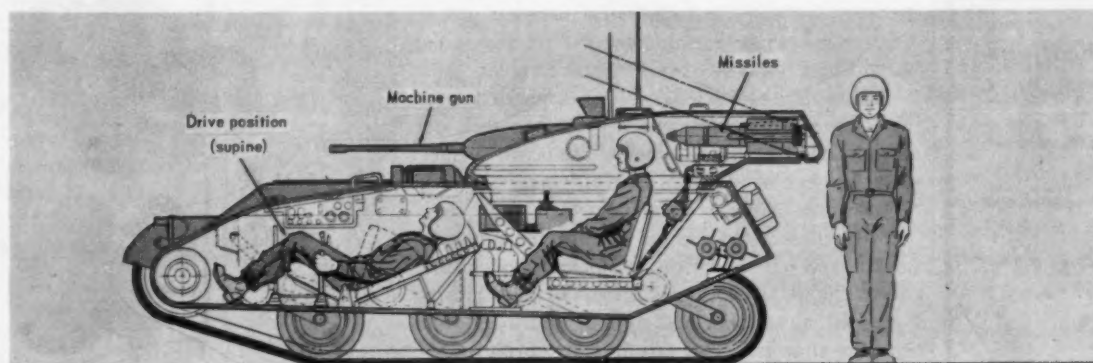
• **AIRBORNE FIVE-TON TANK** can accommodate armament ranging from currently available missiles to projected nuclear weapons.

The proposed two-man tank design concept features light weight realized by a combination of recent materials and automotive, armament and design advances. Crew protection, equivalent to that of current light tanks, is attained by use of aluminum armor—future possibilities include nylon and plastics. Recent progress in the field of nonrecoiling weapons could make the airborne combat vehicle more than a match for the heaviest enemy tank.

Placement of the driver in a horizontal (supine) position when tank is "buttoned up" offers reduced vehicle height (lower silhouette, a smaller target),

a significant weight reduction, since area to be covered by protective armor is reduced, and increased driver efficiency.

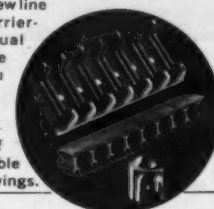
Horizontal driver position is not a new idea in military vehicles. The Howie-Wiley machine-gun carrier tested in February 1937 featured prone driver and gunner positions. A predecessor to the World War II Jeep, this low-silhouette wheeled vehicle was developed as a private project. The development of a five-ton airborne tank which also could be transported by helicopter would be a big step in meeting the Army's objective for complete tactical and strategic mobility, according to Forsyth & Co., Burbank, Calif.



## New! TA'S STANDARD LINE OF TERMINAL BLOCK COVERS

KEEP COSTS DOWN  
PREVENT MALFUNCTIONS

TA's "Terminalship" offers you a complete new line of standard terminal block covers for barrier-type and pegged-type blocks and individual thimble-type studs. Made of non-inflammable Neoprene or Silicone, they offer you complete protection against exposed circuits, dust, grease, water, oil, corrosive chemicals and other short circuiting factors. Easy to install and remove. But best of all, these insulator covers are now available from open stock at tremendous volume savings.



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Write today for your free copy of Bulletin 213G. Gives complete description, sizes, styles and prices for your own evaluation.



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TWX 9363 Glendale, Calif. • WUX CAT Los Angeles, Calif.

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### FILLS A HUNDRED NEEDS

### ...RUSH US MORE

"How did we ever get along without it!"

That's what you'll say about TAPEWRITER. This handy tool creates handsome *permanent* labels with raised letters in contrasting colors on plastic—*right now*, on the spot! Any legend, any length, as fast as you can dial the letters. Self-sticking labels, to colorfully identify your equipment, switches, conduits, files—anything and everything! New users in every field find TAPEWRITER invaluable. Write or wire Dymo for information—or may we give you a personal demonstration?

FIVE MODELS, FROM \$34.95

\*Trademark of Dymo Industries, Inc.

**DYMO INDUSTRIES INC**  
Dept. DN-5 2950 Seventh Street • Berkeley 10, California

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## LOOK TO THE MAN BEHIND THE MANUAL

before  
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in the northeast

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Northeastern Regional Office  
New Hampshire Ball Bearings, Inc.  
Peterborough, New Hampshire  
Tel: WALnut 4-3311



HE HAS ANSWERS TO problems not covered by our 150-page manual. An Instrument Ball Bearing Engineer, he's right in the middle of all new developments pertaining to instrument bearings. He can help you save days—and dollars—on your design projects.

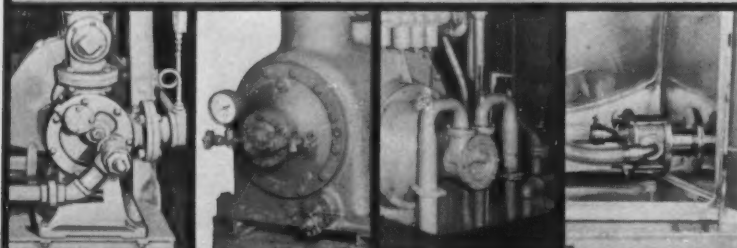
HE WANTS to see to it that our manual is owned by every qualified engineer, draftsman and purchasing agent in his territory. Do you have one?

**NEW HAMPSHIRE** BALL BEARINGS, INC.  
PETERBOROUGH, N. H.

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Let Viking Pump's 50 Years of  
Design Experience Help Solve Your  
**PUMPING PROBLEMS**



Pumping hot oil up to 500° F. Built-in lubricating pump on ice machine Diesel engine lube oil pump, integrally mounted Sanitary pump on bulk milk tank truck

**Viking Pumps used in thousands of applications**

Solving pumping problems is every-day work for Viking Pump engineers. Having experience with thousands of applications over the past 50 years, we know how to apply Viking Pumps on equipment.

Our engineers will welcome the opportunity to help you cut costs, improve efficiency and really work out your pumping problems.

A range of 22 basic sizes from 1/2 to 1050 G.P.M. enables Viking to supply your needs without compromise. Pressures to 200 P.S.I. on heavy-duty models—500 P.S.I. on hydraulic oils.

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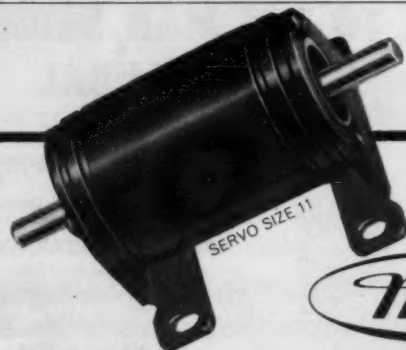


**VIKING PUMP COMPANY**

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See Our Exhibit at the Design Engineering Show  
Booth #1231, Cobo Hall, Detroit, May 20-25

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FROM



**A PART OR A PACKAGE**

**A PART:** Miniature fixed ratio speed changers

**RATIOS:** 448 ratios from 1:1 to 531441:1  
**HORSEPOWER:** .025 maximum  
**TORQUE:** 24 oz-in maximum  
**SPEED:** 10,000 RPM maximum  
**BACKLASH:** Less than 15', on anti-backlash Series 9  
**WEIGHT:** 3 to 6 oz depending on ratio  
**BEARINGS:** double, heavy-duty ball  
**MOUNTINGS:** available with versatile foot mounts  
**DELIVERY:** 10 days

**A PACKAGE:** Call on Metron for help with your speed changing design problems. Tell us what *results* you are after; we'll call on 18 years' experience in making miniature speed changers and precision instruments to come up with the right package for you. Send your prints today—or, better yet, call us now!



**METRON INSTRUMENT CO.**  
432 Lincoln, Denver 3, Colo., PE 3-3764, TWX: DN 194

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**RELEASES**

• U.S. NAVY'S P3V-1 aircraft features the most effective electronic, sonic and magnetic equipment ever launched into the skies to comb out and smash enemy submarines.

The huge sub hunter was dedicated at Lockheed, Burbank Div., by Vice Admiral R. B. Pirie, to be the "longest-reading, hardest-hitting sub clubber in aviation history".

Land-based and spiked with nuclear depth charges, the four-turbined sea hunter will fly farther, faster and flush out its quarry with a sharper electronic eye than any other airplane. Its eyes and ears include radar scanners whose horizon-to-horizon running reports are integrated in a single tactical "brain" compartment.

A wasp-like tail extension houses magnetic anomaly detection equipment designed to seek out submarines lurking deep below the ocean surface. Two bug-eye windows on each side peer out from observation stations, sweeping everything below.

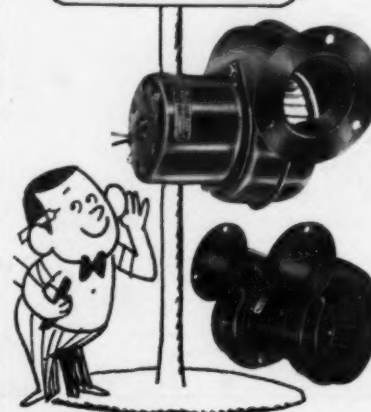
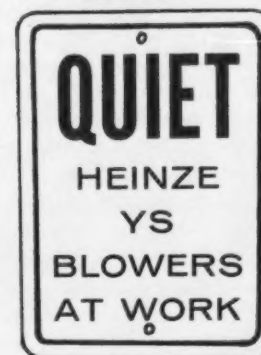
Fully pressurized and air conditioned for maximum crew efficiency on prolonged search missions, the airplane carries a crew of 10. Cruising speed of more than 400 mph is translated into enroute time half that required by current ASW (antisubmarine weapon) aircraft. As an added bonus for watchful waiting at low altitude, the PZ3V-1's two outboard propellers can be feathered to place the engines on a standby basis. Once over target area, it can fly with perfect controllability at speeds of less than 175 mph for sea-level searchers. When full power is needed, engines can be restarted and four-bladed Hamilton Standard propellers upped quickly to full rpm.

Power plants are Allison T56A-10W turbine engines equipped with water-alcohol injection. The aircraft has a 99-ft wing span and an overall length of 116 ft, 10 inches.



**SPEEDING SEAWARD** on evaluation flight, Navy's subclubbing P3V-1—named "Orion" after Greek mythology's "great hunter of mighty strength"—can deliver nuclear depth charges, torpedoes and rockets against undersea aggressors hundreds of miles from domestic shores.

put **HEINZE** in your designs



Slow speed 4 pole shaded pole induction motor and large balanced air rotors minimize air noise to provide smooth, quiet operation. YSS Single Blower delivers 50 cfm at 1650 rpm; YSD Double Blower delivers 100 cfm. 115V, AC, 60 cycle is standard but other voltages or 50 cycle operation may be supplied. Rotation is CW or CCW. CRS housing has baked enamel finish. Variations include square outlet flange, inlet stud or tapped holes, motor vertical up or down.

YS Blowers are widely used in photographic dark rooms, laboratories, kitchens, refrigeration and air conditioning units, vending machines, for cooling electronic tubes, and similar application.

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Company \_\_\_\_\_  
Street & No. \_\_\_\_\_  
City & State \_\_\_\_\_

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• **INTERNATIONAL SATELLITE SPACE PROBE SUMMARY**, as issued by the National Aeronautics and Space Administration, Washington, D. C., reports the following space vehicles in orbit as of March 29, 1961:

Name/Country	Launch Date	Transmitting			
Explorer I (US)	1-31-58	No	Samos II (US)	1-31-61	No
Vanguard I (US)	3-17-58	Yes	Venus Probe (USSR) *	2-12-61	No
Lunik I (USSR) *	1- 2-59	No	Explorer IX (US)	2-16-61	No
Vanguard II (US)	2-17-59	No	Discoverer XX (US)	2-17-61	No
Pioneer IV (US) *	3- 3-59	No	Discoverer XXI (US)	2-18-61	No
Explorer VI (US)	8- 7-59	No	Transit III-B & LOFTI (US)	2-21-61	Yes
Vanguard III (US)	9-18-59	No	Explorer X (US)	3-25-61	No
Explorer VII (US)	10-13-59	Yes			
Pioneer V (US) *	3-11-60	No			
Tiros I (US)	4- 1-60	Yes			
Transit I-B (US)	4-13-60	No			
Spacecraft I (USSR) *	5-15-60	No			
Midas II (US)	5-24-60	Yes			
Transit II-A (US) *	6-22-60	Yes			
NRL Satellite (US) *	6-22-60	Yes			
Echo I (US)	8-12-60	No			
Courier I-B (US) *	10- 4-60	Yes			
Explorer VIII (US) *	11- 3-60	No			
Tiros II (US)	11-23-60	Yes			

\*In solar orbit; others in earth orbit.

Current Summary (March 29, 1961)	Complete Summary (Launched to date)
Earth Orbit: US, 21 USSR, 1	Earth Orbit: US, 37 *USSR, 11
Solar Orbit: US, 2 USSR, 2	Solar Orbit: US, 2 USSR, 2
Transmitting: US, 9 USSR, 1	Lunar Impact: USSR, 1

\*Lunik III passed once around the moon, then into earth orbit.

## TIPS ON

### SELECTIVE PLATING

#### Versatile Put-On Tool Proves Money Saver in Design and Electronics

With the advent of the SELECTRON Process, selective plating, a technique formerly limited to the hobby shop, has now come of age.



SELECTRON is now being used in field repairs, in R & D, and in light manufacturing. Typical applications include gold or rhodium plating of printed circuits, silver plating of bus bar and electrical contacts, repair of flanges on wave guides, precision fitting of bearings for electromechanical devices, and improvement of solderability of stainless steel, aluminum and semi-conductors.

Automated SELECTRON installations are finding use in production plating on isolated areas of trans-

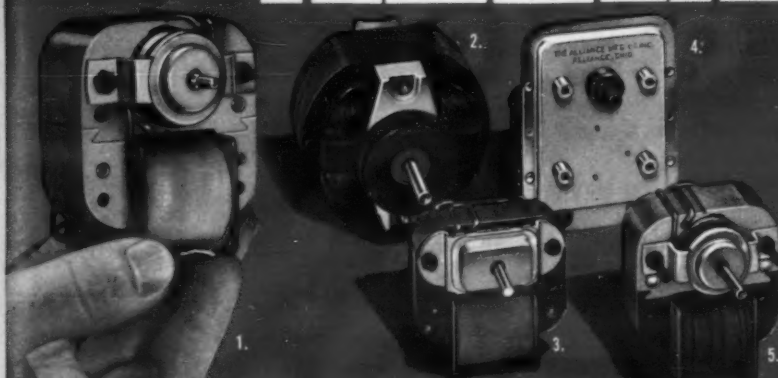
sistor tabs and for gold plating of capacitor leads. One ever-expanding use for SELECTRON is for prototype work. SELECTRON units—occupying only the area of a desk top—are currently electrodepositing almost any platable metal or alloy, from antimony to zinc, upon any conductive basis material.

An information-packed 8-page booklet on its many advantages is available on request from SELECTRON, Ltd. 520 Fifth Ave., New York 36, N. Y.

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## Choose from ALLIANCE



1. New Synduction Motor—A low cost synchronous motor! Has hysteresis features at shaded pole price. Constant speed for phonographs, tape recorders, chart drives, timing devices, etc.
2. "L" Motor—Shaded pole motor for typewriters, business machines, etc.
3. "H" Motor—High starting torque, compact design for gear trains, air circulation, etc.
4. "JSG" Gearmotor—For rotisseries, vending machines, remote controls, etc.
5. "JS" Motor—Proven dependability! For fans, heaters, pumps, recorders and many others.

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Alliance, world's largest producer of sub-fractional HP motors, offers the widest choice of standard and custom models, faster service, more for your money. Used in leading makes of phonographs, tape recorders, appliances, business machines, animated displays and other products—all can be customized to your own specifications.

Write for complete catalog—price quotations upon request  
The Alliance Manufacturing Co., Inc., Alliance, Ohio  
(Subsidiary of Consolidated Electronics Industries Corp.)

Model	Voltage	Starting Torque Oz./In.	Amps	Watts	RPM	Weight
Synduction	117	1.0	.27	18	3600	1 Lb. 14 Oz.
L	117	6.5	1.2	77	3250	4 Lbs.
H	117	1.0	.31	17	2500	1 Lb. 6 Oz.
JSG	117	225	.49	25	12-14	1 Lb. 7 Oz.
JS	117	2.70	.67	42	2900	1 Lb. 13 Oz.

## ALLIANCE MOTORS

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DESIGN NEWS—MAY 8, 1961

## LOOK TO THE MAN BEHIND THE MANUAL

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HE'LL TELL YOU what our 150-page manual can't. An Instrument Ball Bearing Engineer, he's ready to help you design around standard types and sizes to speed your new developments and cut your costs. He can also consult on the design of special bearings.

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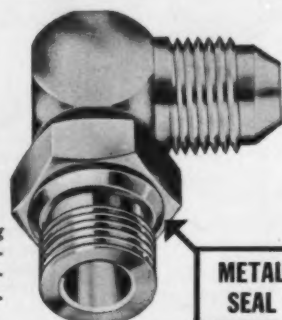
## NEWS FROM THE ORIGINATORS OF METAL-SEAL FITTINGS

the 'CN' metal-seal  
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**ALL** straight-thread ports

Seal Ports in ALL Base Metals—  
Steel, Cast Iron, and Aluminum:  
L & L's 'CN' fittings are now made  
with a new special metal seal ring  
that works perfectly no matter what  
the component base metal.

Seal ALL Straight-Thread Port Designs—  
There's no change in the ability of 'CN' fittings  
to seal perfectly the S.A.E. port design, as well  
as the UN port design (the ultimate port for  
both O-ring and metal seal fittings).

Captive nut wedges the metal seal ring  
into port angle. Resulting seal is unaf-  
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peratures. Seal can be remade repeatedly.



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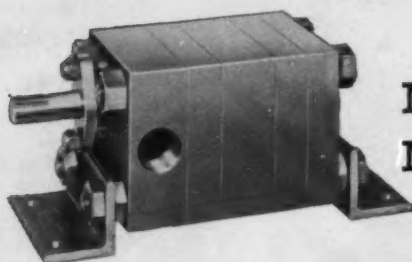
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*for pumps as individual  
as a fingerprint!*



**SPECIFY  
NORTHERN  
NITRALLOY  
PUMPS**



Northern designs and builds quality into every pump. For each application, materials are selected with infinite care—gears with ground tooth form for perfect contact, correct clearances. Meticulous inspection at every stage in the manufacturing process assures efficient, economical, lasting service for even the most difficult pumping tasks under rugged conditions, indoors and out, year after year.

Northern Nitralloy Pumps are available in capacities from 1/4 to 146 GPM at pressures up to 2000 PSI. Within this range there is a pump as individual as a fingerprint—as "special" as you want it.

Write today for free catalog and engineering data.

**Northern Ordnance Incorporated**

Subsidiary of NORTHERN PUMP COMPANY  
Minneapolis 21, Minnesota

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## RELEASES

\* "DESIGNING IS SAVING—With Steel" will be the Armco Steel Corp.'s theme at the Design Show, Booth, Nos. 409-415.

Featured will be a special display on paintable zinc-coated steel, high-strength, low-alloy steels, the Sheffield Div. SSS-100 structural steel and a series of stainless and coated-steel fabricated products.

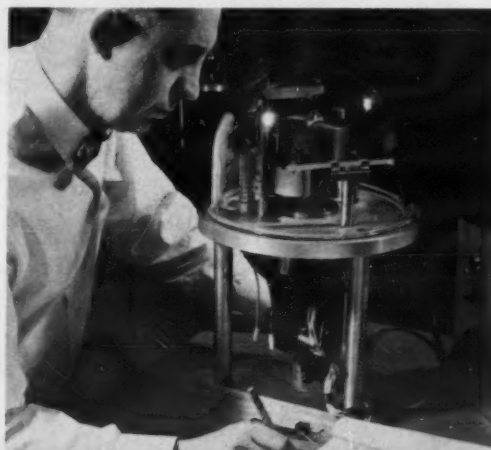
One "theme" stresses weight savings possible through design. Examples will include a new racing engine that saved weight by using stainless-steel sheet in place of cast iron. An explosion-formed aircraft wing span of PH 15-7 Mo will be on display. Also, displayed will be a new stainless quick-connect coupling of 17-4 PH that saved the manufacturer 52 percent in final part cost over an SAE 4140 coupling.

• **BALL-BEARING SIMULATOR** can reproduce precisely major characteristics of critical friction devices simply and cheaply.

Three simulators are believed to be the only machines of their kind in existence. They are presently able to duplicate the performance of any high-speed, high-temperature, low-lubricant bearing, such as those employed in miniaturized gyroscopes, motors or computer memory drums for missiles or space vehicles.

The machine, a table-top device enclosed under a sealed-glass cover, exactly simulates such bearing characteristics as operating temperature, atmosphere, ball-to-race contact pressure and surface speed roll-to-spin ratio, and amount and type of ball lubricant.

Although the ball-bearing simulator was developed primarily to solve in-company bearing problems, the Sperry Gyroscope Co., Div. of Sperry Rand Corp., states that other manufacturers and at least one military agency have shown interest in the simulator's capabilities.



# STOP!



## COSTLY LEAKS OF VALUABLE FLUIDS

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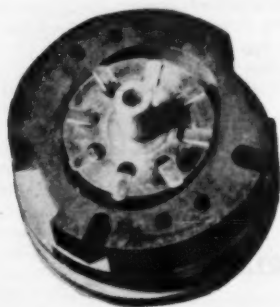
**DURAMETALLIC CORPORATION**  
KALAMAZOO, MICHIGAN

Circle 245 on Reader-Service Card

• **SUBMINIATURE VANE PUMP CARTRIDGE** won a certificate of excellence in 1960 Miniaturization Awards Competition. The product was cited for "exhibiting ingenuity in solving basic miniaturization problems of broad interest to industry".

Developed by Vickers Aero Hydraulics Div., the cartridge offers new flexibility to designers of fluid systems handling either liquid or gaseous fluids. It weighs only 1 oz and is  $\frac{3}{4}$  inch in dia. The unit delivers 0.3 to 1.3 cu in per revolution and its speed range is 8000 to 26,000 rpm. The cartridge is built to precision watchmaker standards involving tolerances of 0.0001 inch or less.

The award was presented by Miniature Precision Bearings, Inc., Keene, N. H., sponsor of the national competition, at the Fourth Awards dinner in New York.

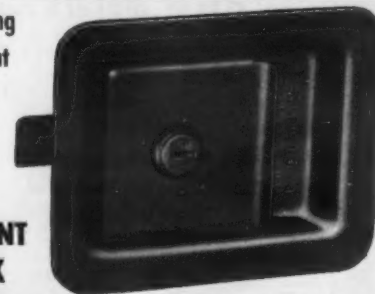


## Meetings

Swampscott, Mass. May 15-16	PACKAGING INDUSTRY CONFERENCE, American Institut of Electrical Engineers, New Ocean House.
Washington, D. C. May 15-17	NATIONAL SYMPOSIUM ON MICROWAVE THEORY AND TECHNIQUE, Institute of Radio Engineers, Sheraton-Park Hotel.
Philadelphia, Pa. May 22-24	ANNUAL CONVENTION AND EXHIBITION, American Society for Quality Control, Sheraton Hotel.
Detroit, Mich. May 22-25	DESIGN ENGINEERING SHOW AND CONFERENCE, (conference sponsored by the Machine Design Div. of The American Society of Mechanical Engineers), Cobo Hall.
New York, N.Y. May 22-26	ENGINEERING CONFERENCE AND EXHIBIT, American Society of Tool and Manufacturing Engineers, New York Coliseum and Statler Hotel.
Dayton, Ohio May 23	FRACTIONAL HORSEPOWER MOTORS CONFERENCE, American Institute of Electrical Engineers, Biltmore Hotel.
Pittsburgh, Pa. June 4-8	ANNUAL MEETING, American Nuclear Society, Penn-Sheraton Hotel.
St. Louis, Mo. June 4-9	SUMMER MEETING, Society of Automotive Engineers, Chase-Park Plaza Hotel.

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You Could Want

## IN A COMPARTMENT DOOR LOCK



MOUNTS FLUSH • INTERCHANGEABLE LEFT OR RIGHT  
No. 4895 (Key Locking)

Designers and Builders alike welcome this job-proved lock for its multiple advantages, exclusive operational features and ease of installation.

It's a time saver when installed as it easily "slam-locks" after key removal.

A thief stopper on your compartment door. LOCK IS EASILY OPERATED BY PULLING PADDLE HANDLE OUTWARD. Measures  $5\frac{1}{2}$ " x  $4\frac{1}{4}$ " at pan edges. Installs with screws, rivets or welding.

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**The EBERHARD MFG. CO.**

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## Insist on genuine CROSBY CLIPS the clip with the red U-bolt®

Today's largest-selling clip... because it's safest! Drop-forged base, high wings, and snug-fit channel, assures 100% holding power. Hot-dip galvanized to resist corrosion. World's widest range of sizes,  $\frac{1}{8}$  to 3", assures perfect fit. Don't risk lives or loads... be sure you get genuine CROSBY CLIPS.

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Free catalog gives data on 2000 types and sizes of forged fittings for wire rope and chain. Ask your distributor for your copy.

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Division of  
**AMERICAN  
HOIST**

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## LOOK TO THE MAN BEHIND THE MANUAL

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**NEW HAMPSHIRE** BALL BEARINGS, INC.  
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**FHP motors... engineered especially for your product**



**RAE**  
motors

The new RAE M-40 Series, in 3 ratings at 5000 RPM. AC/DC Universal or DC Shunt. M-41 and M-42 rated 1/2 H.P. M-43 and M-44 rated 3/4 H.P. M-45 and M-46 rated 1 H.P. Available with any of RAE's gear units.

RAE engineers are recognized specialists in solving difficult FHP motor applications. By careful analysis and testing of your product, they can save you time and money in selecting the right motor.

RAE offers outstanding service and quality in a large variety of motors. Available in voltages up to 250, and up to 1/2 H.P. (higher for intermittent duty) with many gearhead motor combinations.

Find out how RAE motors can improve your product and reduce costs as they are doing for other leading manufacturers.

\*Send for the "RAE" Engineering Data Sheet. It will help you supply the data necessary for recommendations and prices.



AC/DC Universal • DC Shunt Wound • DC Series Wound • Gear Reduction Motors • Governor Controlled Motors • Motors for Rheostat Control • Motors for Electronic Control • Permanent Magnet Motors and Geomotors.

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*in the west*

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HIS JOB STARTS where our 150-page manual stops. He's an Instrument Ball Bearing Engineer. He's a good man to talk with before your designs are frozen. Maybe he can save you time and money. It costs nothing to find out.

HE'S ALSO THE MAN to contact if you don't already own our manual, the nearest thing to a textbook on miniature and instrument ball bearings ever published.



**NEW HAMPSHIRE BALL BEARINGS, INC.**  
PETERBOROUGH, N. H.

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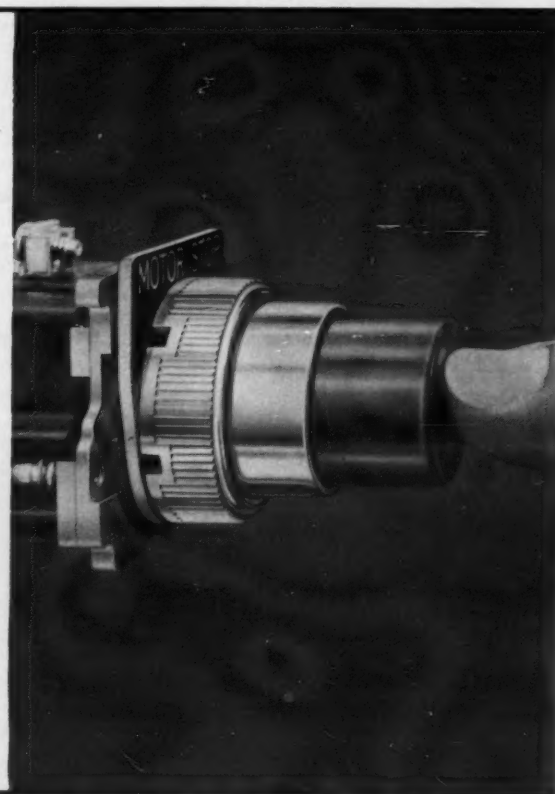
## New! Versatile Cutler-Hammer oiltight pushbuttons let you make any station you want

The new interchangeability built into these operators lets you create the station you want from a complete selection of Cutler-Hammer pushbuttons. Get them in one hole or base mounting, 6 bright colors. Thirty different circuit arrangements can be made in hundreds of varieties of stations in standard arrangements of up to 25 elements. Get up to 8 circuits on one pushbutton. They take 40% less back-panel space than next smallest unit so you get more control in less space. Get facts in PUB. LO-104-K272.

WHAT'S NEW? ASK...

### CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S.A.



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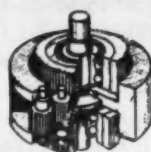
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WAR TERMINATION INVENTORIES

WRITE OR WIRE FOR INFORMATION ON OUR COMPLETE LINE OF SURPLUS ELECTRONIC COMPONENTS. ALL PRICES NET F.O.B. PASADENA, CALIFORNIA

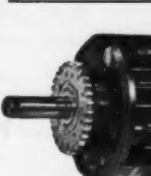
**C&H**  
SALES CO.

2176-E East Colorado St.  
Pasadena 8, California  
MUrray 1-7393



### SIMPLE DIFFERENTIAL WITH BALL-BEARING SUN GEARS

The 1:1 reverse ratio spur gears are 48-tooth, 32 pitch brass with 3/16" available face. On one side, the shaft is 23.64" dia. for 11/16" and has a pin hole, then increases in dia. to .377" for the remaining 3/16" of length. On the other side, the shaft is .377 dia. 1/4" lg. 2-13/16" dia. is required to clear the body. Stock no. A6-115 ..... each \$15.00



### SIMPLE DIFFERENTIAL WITH SPACED OUT SUN GEARS

1:1 reverse ratio spur gears are aluminum, 3/32" face, 32 pitch, 32 teeth on one side, 48 teeth on the other. The body is 1/4" thick, but the sun gears are spaced out so that they are 1 1/2" apart. 1/2" dia. shaft on each side is 23/32" long. OA length 3 1/2". Requires 1-23/32" dia. to clear the body. Stock no. A6-124 ..... each \$4.50

### SIMPLE DIFFERENTIAL

1:1 reverse ratio, 40 teeth on large gear; 1/4" shaft. Size: 3" long with 1-15/16" dia. Stock no. A6-104 ..... each \$3.95

### DUAL SIMPLE DIFFERENTIAL

1:1 reverse ratio on both. Size: 3 1/2" long x 1-7/16" dia. Shaft size: 1/4" and 5/32". Stock no. A6-107 ..... each \$7.50

### SPERRY VERTICAL GYRO

Part #653265. Motor 115 volts, 3 phase, 400 cycle, 8 watts, 20,000 RPM. 3-minute runup, synchro pickups, roll 360°, pitch 85°. Synchro excitation 26 volts 400 cycle, 150 m.a. Vertical accuracy ± 1/2". Weight 3 1/2 lbs. Approx. dim. 5 1/2" L, 4 1/2" W, 4 1/2" H. Price \$35.00

### MINNEAPOLIS-HONEYWELL RATE GYRO (Control Flight)

Part no. JG7005A, 115 volts A.C., 400 cycle, single phase potentiometer take off resistance 530 ohms. Speed 21,000 r.p.m. Angular momentum 2 1/2 million, CM²/sec. Weight 2 lbs. Dimensions 4-7/32 x 3-29/32 x 3-31/64. Price \$22.50

### VARIABLE SPEED BALL DISC INTEGRATORS

(All Shafts Ball Bearing Supported)  
No. 145 Forward & Reverse 2 1/4"-0-2 1/4". Input shaft spline gear 12 teeth 9/32" dia. 1/4" long. Output shaft 15/64" dia. x 15/32" long. Control shaft 11/32" x 1/4" long. Cast aluminum construction. Approx. size 3" x 3" x 2 1/2". ..... \$17.50  
No. 146 Forward & Reverse 4-0-4. Input shaft 5/16" dia. x 1/2" long. Output shaft 15/64" dia. x 9/16" long. Control shaft 11/64" dia. x 11/16" long. Cast aluminum construction. Approx. size 4 1/2" x 4 1/2" x 4". ..... \$18.50 ea.

### SMALL DC MOTORS

(approx. size over 3 1/2" x 1 1/2" dia.)  
5067043 Delco 12 VDC PM 1" x 1" x 2", 10,000 rpm. ..... \$7.50  
5067126 Delco PM, 27 VDC, 125 RPM, Governor Controlled ..... 15.00 ea.  
5069600 Delco PM 27.5 VDC 250 rpm ..... 12.50  
#5069625 120 rpm, mfr. Delco, 27 VDC governor controlled ..... \$15.00  
5069230 Delco PM 27.5 VDC 145 rpm ..... 15.00  
5068750 Delco 27.5 VDC 160 rpm w. brake 6.50  
5068571 Delco PM 27.5 VDC 10,000 rpm (1x1x2") ..... 5.00  
5069790 Delco PM, 27 VDC, 100 RPM, Governor Controlled ..... 15.00 ea.  
#5069800 575 rpm, mfr. Delco, 27 VDC, PM reversible governor controlled, equipped with 27 VDC clutch ..... \$17.50  
5072735 Delco 27 VDC 200 rpm governor controlled. ..... 15.00  
5BA10A118 GE 24 VDC 110 rpm ..... 10.00  
5BA10AJ37 GE 27 VDC 250 rpm reversible ..... 10.00  
5BA10AJ52 27 VDC 145 rpm reversible ..... 12.50  
5BA10AJ50, G.E., 12 VDC, 140 rpm ..... 15.00  
5BA10FJ4018, G.E. 28 VDC, 215 rpm, 10 oz. in., 7 emp. contains brake ..... 15.00  
5BA10FJ421, G.E. 26 VDC, 4 rpm, reversible, 6 oz. in., .65 amp ..... 15.00

### 400 CYCLE PM GENERATOR

Mfgd. by T K M Electric Corp.  
Model #A-12  
120/208 volts, 400 cycle, 1 or 3 phase, 1 kva, pf 0.8, rpm 8,000. Approx. dim. 6" x 5 1/2". Internal spline drive. Price \$100.00

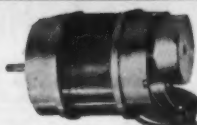
### 400 CYCLE 1/2 PHASE GENERATOR

115 VAC. 3 KVA. Mfg. Bogue Elect. Mod. 28005. External excitation 107 VDC. 1.1 amp. 3450 rpm. 1" shaft. Price \$200.00

### 400 CYCLE MOTOR GENERATOR

2kw, 208/115 volt AC, 3 phase, 400 cycle  
Input: 220 volts AC, 60 cycle, 3 phase  
3 h.p. motor  
Unit manufactured by Bogue  
Consists of squirrel cage induction motor driving through a flexible tubing, a salient pole, synchronous generator, with direct connected exciter.  
Unit complete with starting contractor, voltage adjusting rheostat, carbon pile voltage regulator and 28 volt DC, 5 amp rectifier power supply.  
Price ..... \$450.00

### SELSYNS- SYNCHROS



1CT cont. Trans 90/55V 60 cy.....	\$27.50
1DG Diff. Gen. 90/90V 60 cy.....	34.50
1F Syn. Mtr. 115/90V 60 cy.....	34.50
1G Gen. 115V 60 cy.....	34.50
1HDG .....	37.50
1HCT .....	12.50
1SF Syn. Mtr. 115/90V 400 cy.....	34.50
23TR4 torque receiver.....	37.50
23TR6 torque receiver.....	37.50
23CT6 control transformer.....	37.50
23CX6 control transmitter.....	37.50
7DG differential generator.....	7.50
21JF1 Gen. 115/57.5V 400 cy.....	10.00
21JF3 Gen. 115/57.5V 400 cy.....	7.50
21JF4 Gen. 115/57.5V 400 cy.....	5.00
21JG1 57.5/57.5V 400 cy.....	7.50
21JH1 Diff. Gen. 57.5V 400 cy.....	17.50
21SD1 Cont. Trans. 105/55V 60 cy.....	17.50
21SF1 Cont. Trans. 105/55V 60 cy.....	17.50
21SH1 Gen. 115/105V 60 cy.....	17.50
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6DG Diff. Gen. 90/90V 60 cy.....	34.50
6G Syn. Gen. 115/90VAC 60 cy.....	42.50
7G Syn. Gen. 115/90VAC 60 cy.....	20.00
C56701 Type 11-4 Rep. 115V 60 cy.....	20.00
C69405-2 Type 1-1 Transm. 115V 60 cy.....	20.00
C69406 Syn. Transm. 115V 60 cy.....	20.00
C69406-1 Type 11-2 Rep. 115V 60 cy.....	12.50
C78248 Syn. Transm. 115V 60 cy.....	20.00
C78410 Repeater 115V 60 cy.....	30.00
FPE 49-7 Diehl servo motor, 115 volts, 60 cycle, 10 watts.....	30.00

### 400 CYCLE, 3 PHASE GENERATOR

BY MASTER ELECTRIC Type AG, frame 364Y, 7.5 kw, 3428 rpm, pf .95 5ter connected 120/208 3 phase, 22 amps. Delta connected 120 volt single phase 6 amps. Self excited. Complete with control box, voltage regulator, AC voltmeter and frequency meter. Shaft 1" dia., 2" long; overall dim. of unit: 21" x 18" x 20". Price \$395.00 each



### SILICON RECTIFIERS

All rectifiers listed at maximum peak inverse voltage ratings; approximate forward voltage drop, 1.5 volts

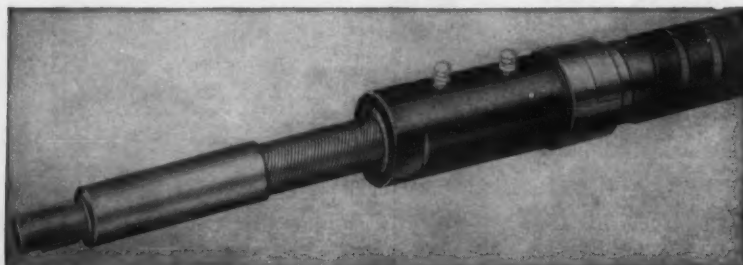
1N1446	.750 amp.	100 volts	.65
1N1447	.750 amp.	200 volts	.75
1N1448	.750 amp.	300 volts	.85
1N1449	.750 amp.	400 volts	1.00
1N1551	1 amp.	100 volts	.80
1N1552	1 amp.	200 volts	.95
1N1553	1 amp.	300 volts	1.10
1N1450	5 amp.	100 volts	1.00
1N1451	5 amp.	200 volts	1.25
1N1452	5 amp.	300 volts	1.50
1N1453	5 amp.	400 volts	2.00
1N1454	25 amp.	100 volts	3.00
1N1455	25 amp.	200 volts	3.50
1N1456	25 amp.	300 volts	4.50
1N1458	35 amp.	100 volts	3.50
1N1459	35 amp.	200 volts	4.00
1N1460	35 amp.	300 volts	4.50
1N1461	35 amp.	400 volts	5.00
1N05P7	50 amp.	50 volts	6.00
1N1462	50 amp.	100 volts	7.00
1N05R7	75 amp.	50 volts	9.00
1N1466	75 amp.	100 volts	10.00
1N1467	75 amp.	200 volts	11.00
1N1468	75 amp.	300 volts	12.50
10T7	100 amp.	100 volts	13.00
00T7	100 amp.	150 volts	13.50
1N05V7	150 amp.	50 volts	16.50
1N1474	150 amp.	100 volts	17.00

Mounting for full wave bridge circuit to accommodate .750 amp. rectifiers. .75¢ each

Circle 249 on Reader-Service Card for more information



# HOW TO SELECT FLEXIBLE SHAFTING FOR POWER DRIVE APPLICATIONS



1 1/4-inch STOW Power Drive flexible shaft with core assembly pulled out of casing.

For Power Drive applications, the following factors must be considered:

1. **Torque (Lb. in.)** to be transmitted. (The starting torque should be used in making selections.)

2. **Operating Speeds (RPM)**—If the maximum speed is higher than the rated speed, torque ratings in the table below do not apply. To find the torque capacity for flexible shafts operating at speeds higher than the rated speeds, multiply the maximum dynamic torque capacity by the rated speed, and then divide by the operating speed. (See example.)

3. **Operating Radius**—In making the selection from the table below, the radius of the smallest bend in the flexible shaft should be used.

**Ratings**—The ratings for flexible shafts shown in the table below apply under the following conditions:

1. When the flexible shaft is adequately supported by clamps along its length. (For unsupported shafts, multiply the calculated torque by a safety factor of 1.6—see example below.)

2. When the flexible shaft is operated in the wind-up direction, which tends to tighten the outer layer of wires. (Flexible shafts operated in the unwind direction will transmit only about 60% of the rated torque.)

3. When the flexible shaft is in continuous operation. (Note: the ratings are based on temperature rise. When the operation is intermittent, the ratings in the table may be exceeded. Consult Stow engineers for specific recommendations.)

RATED SPEED R.P.M.	MAXIMUM DYNAMIC TORQUE CAPACITY (LB. IN.)									Wgt./ C. Ft.	Core Dia.	Core No. and Type	Shaft Size
	STRAIGHT AND CURVED SHAFTS												
	RADIUS OF CURVATURE IN INCHES												
	50 to straight	25	20	15	12	10	8	6	5				
4,500	2.4	2.2	2.0	2.0	1.92	1.9	1.7	1.5	1.25	3.0	.124/.128	2049 MH	13
3,800	7.0	6.4	6.0	5.8	5.4	5.0	4.6	3.6	2.0	4.5	.148/.152	2081 MH	15
2,900	9.4	8.6	8.0	7.6	7.0	6.6	6.0	4.8	3.4	7.0	.185/.189	5108 MH	19
2,500	22.0	20.0	18.8	17.6	16.0	15.0	12.6	10.8	9.0	12.5	.247/.252	8924 MH	25
1,800	30.0	28.0	26.4	25.0	23.0	21.0	18.0	14.0		20.0	.308/.313	8925 MH	31
1,800	33.8	31.5	29.7	28.1	25.9	23.6	20.2	15.8		20.0	.308/.313	8969 T	31
1,800	36.0	33.0	31.6	30.0	28.0	26.0	22.0	18.0	11.0	21.0	.324/.329	2034 A	31
1,500	80.0	66.0	63.0	59.0	51.0	46.0	37.0	22.0		28.5	.368/.374	2035 A	38
1,500	60.0	54.0	50.0	46.0	42.0	38.0	30.0	24.0		29.0	.387/.393	8970 MH	40
1,500	90.0	81.0	75.0	69.0	63.0	57.0	45.0	36.0		29.0	.387/.393	8971 T	40
1,150	136.0	110.0	104.0	94.0	80.0	72.0	56.0			50.5	.497/.503	8999 A	50
1,150	148	124	110	92	72	56				53.5	.505/.511	6940 T	50
900	248	200	176	124	84					78.5	.610/.618	6997 T	63
900	220	204	192	180	152	130				80.5	.630/.638	7731 A	63
750	340	224	156	76						117	.747/.753	2056 T	75
600	760	520	430							203	.998/1.004	2057 T	100
440	1,500	720								343	1.298/1.304	2058 T	125

**EXAMPLE** — How to use the table:  
The problem is to transmit 1/2 HP at 1700 RPM through an unsupported flexible shaft in a 25" radius, estimated starting torque 150% of normal operating torque.

1. Calc. Torque (lb. in.) —  

$$\frac{HP \times 63000}{RPM} = \frac{.5 \times 63000}{1700} = 18.5$$

2. Correction factor for starting torque  
 $1.5 \times 18.5 = 27.75$

3. Correction factor for unsupported shaft  $27.75 \times 1.6 = 44.4$  lb. in.

4. Refer to Table above. Read downward in column under 25" radius until you find a core having a rating of at least 44.4 lb. in. In this case we find that core No. 8970 is rated 54 lb. in. at 1500 RPM. Since the given speed is 1700 RPM, multiply 84 by 1500 and divide by 1700.  $84 \times 1500 \div 1700 = 47.6$  lb. in. (rated torque at 1700 RPM). Therefore, Core No. 8970 is correct.

For Engineering Bulletin No. 570 and a free torque calculator, write



**MANUFACTURING CO.**

308 Shear Street • Binghamton, New York

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## PLANS AND CROSS-SECTIONS

### What Sort of Shape Is the World in?

For the first time, scientists can measure the shape and size of the earth with a precision of from 30 to 50 ft, according to Drs. Fred L. Whipple and George Veis of the Smithsonian Astrophysical Observatory. This is 10 times better than pre-satellite techniques using older methods of geodesy, such as gravity measurements and precision position determinations by star observations.

Analysis of satellite motions has shown earth irregularities from pole to pole. The equator itself is not a circle but el-

liptical. These results mean that the earth may have either irregularities in shape or vary in density from place to place.

To locate these irregularities geometrically within 30 to 50 ft, artificial satellites are being observed from 12 precision satellite tracking stations located around the world. Other stations are being added to the system. When the geodetic coordinates of all the countries of the world are united in one system, results will be 10 times again more precise than those known today.

### Take a Deep Breath

A system to convert an astronaut's breath into breathable oxygen is being designed at Battelle Memorial Institute. It is planned for use on space voyages lasting as long as three years.

Sponsored by the Air Force, the research has resulted in a working prototype of a device to convert carbon dioxide into water.

The apparatus receives carbon dioxide at the rate of 500 cc per minute. The carbon dioxide reacts with hydrogen over

a heated iron-containing catalyst (a combination of steel wool and iron oxide pellets) to produce water vapor and solid carbon.

The condensed water vapor will be fed to an electrolytic cell, now under development, where it will be broken down into breathable oxygen and hydrogen. The latter will be used to react with more carbon dioxide. Solid carbon will be removed from the reactor every two or three days and discarded.

### Shine on, Shine on, Hollow Moon

The moon is similar to a hollow sphere, heavier on the outside than on the inside, according to data from the Vanguard satellite and theories about the moon. Most scientists believe the moon is denser in the interior but it could possibly have become heavier on the outside from heavy meteors falling on the surface.

Dr. Gordon J. F. MacDonald of the National Aeronautics and Space Agency believes the moon was originally hot because its radius has not changed much since it was formed. This he concluded from studies of photographs of the moon. He said none of the moon mountains (craters) showed one side had moved relative to the other as they would if the radius had changed.



Don't hesitate to ask any other idiotic questions you may have.

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WF-220

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


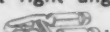
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The **only** contacts you pay for in an AMPin-cert printed circuit edge connector are the ones you actually **use** for your specific circuitry, and here's why: AMPin-cert contacts are not fully pre-loaded into the housing. The unique AMP design, crimping wire directly to the contact, permits you to attach conductors to contacts **before** you load them. When you don't need two or three or six or seven of the available contact cavities, or a complete row of cavities in the case of one-sided boards, you don't load the contacts . . . and you don't pay for them!

So much for economics. What about contact versatility? The AMPin-cert line has five distinct types of contacts: Type I, AMP-leaf , a configuration which guarantees contact forces even on minimum-thickness boards. Type II, AMP-blade , a molded male tab housing to insure proper tab alignment, and a crimped type snap-in female receptacle offering three long, positive contact areas. Type III, DUO-Tyne , affords extremely high density, has four contact areas. Type IV, the right-angle AMP-flag DUO-Tyne , allows conductors to come out of connector at right angles, for easy cabling. Type V, AMP-taper in , ideal for quick jumpering, circuit change-over applications, accepts AMP taper pins.

Quality? AMPin-cert is quality, in the contacts and the housings:

- Contacts are phosphor bronze, gold over nickel plating
- Contacts accept single, multiple leads, and "snap-in" the housing without insertion tools
- Contacts are recessed in housing—no post insulation required
- AMPin-cert connectors will accept one-sided and two-sided boards

Ask us for the full AMPin-cert printed circuit connector story.

# AMP INCORPORATED

**GENERAL OFFICES: HARRISBURG, PENNSYLVANIA**

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Published bi-weekly by Rogers Publishing Co., Inc., a Subsidiary of Cahners Publishing Co., Inc. Norman L. Cahners, Chairman of the Board; E. S. Safford, President; Saul Goldweitz, G. F. Taylor, Vice Presidents. Editorial, Advertising and Subscription Offices: 3375 S. Bannock, Englewood, Colo. Telephone: SUNset 9-0571. Printed at 85 W. Harrison St., Chicago 5, Ill. Accepted as Controlled Circulation Publication at Chicago, Illinois. Send form 3579 to subscription offices.

Circulated to design engineers in the U.S. original equipment manufacturing industry—plants with more than 20 employees and which manufacture machinery or equipment of their own design. Design engineers responsible for specification of components, materials or engineering department may receive DESIGN NEWS without charge. Written request on company letterhead required. Subscriptions to others in continental United States, \$1 per copy, \$20 per year. Please send requests for subscriptions and change of address to Circulation Manager, DESIGN NEWS, Englewood, Colorado.

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## DESIGN NOTES

# C/R offers new bonded CRS Seal design in standard sizes — without premium tooling charges



CRS



CRS-A



CRSH



CRSH-A



### Design Advantages

The CRS Seal now provides a new level of C/R Seal performance through its simple, bonded design. There are no internal parts to misalign, no avenues for internal leakage. The shell and sealing member are integral — bonded securely for the long life of the seal. The CRS Seal incorporates a sealing member with both improved lip configuration and improved concentricity. The sealing member has been strengthened over former designs by placing more material at points of major flex and wear — and without increased shaft loading.

### Designer Advantages

The CRS Seal gives the designer one, basic, rugged shaft seal design which may be applied with high reliability to the great majority of common shaft seal applications — particularly in industrial, automotive, farm, and off-the-road equipment.

Four basic design variations are available. As you can see, these provide an auxiliary sealing lip, where it may be required, or provide extra rugged shell construction where conditions suggest the need to protect the seal lip against assembly damage — or where large, heavy-duty shafts are being sealed.

Selection of the new C/R Type CRS Seal gives the designer and buyer major advantages over special seals: shorter lead time on orders, simpler specification, savings in time and money, and improved assembly quality and reliability.

### Operating Maximums\*

Shaft Speeds	3600 fpm (single lip) 2500 fpm (double lip)
Run-out	.016" TIR dynamic eccentricity .010" static eccentricity
Temperature	—30 to +275°F. (225°F. in EP lube)
Pressure	5 psi (single lip) 10 psi (double lip)
Media	Oil, grease, fuel, water

\*Not all conditions present in one application

### New, Improved Compound

Standard sealing members for the C/R Type CRS Seal are molded of a new Sirvene synthetic rubber compound having markedly superior sealing and wearing properties. It is a Buna-N-based material with low-friction characteristics. The CRS Seal can also be furnished in the usual special materials such as acrylates, Sili-

cones, and butyls. Shells are of standard steel, but can be provided in corrosion-resistant materials on special order.

### Consult C/R Engineers

For assistance on the application of the new CRS — or on any oil seal problem, get in touch with C/R Oil Seal Engineers. They're specialists in fluid sealing — and will gladly cooperate with you.

### For More Design Data:

You will want the complete design data on the new CRS Seal. Write for our Bulletin CRS-100. It gives you the complete list of standard sizes, widths, O.D.'s, shell thicknesses and sealing lip heights. You will want it to compare and then specify C/R's CRS Seal.

### CHICAGO RAWHIDE MANUFACTURING COMPANY

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May 8, 1961

Design News